



**Federal Aviation  
Administration**

***Draft***

**Programmatic Environmental Assessment for the  
Shuttle Landing Facility Reentry Site Operator License  
October 2020**



## Draft Programmatic Environmental Assessment (PEA) for the Shuttle Landing Facility (SLF) Reentry Site Operator License

**AGENCIES:** Federal Aviation Administration (FAA), lead federal agency; National Aeronautics and Space Administration, U.S. Space Force, U.S. Fish and Wildlife Service, and the National Park Service, cooperating agencies.

This PEA is submitted for review pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S. Code 4321, et seq.); Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations Parts 1500-1508)<sup>1</sup>; and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

**DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION:** The FAA is evaluating Space Florida's proposal to operate a commercial space reentry site at the SLF at Cape Canaveral Spaceport in Florida. To operate a commercial space reentry site at the SLF, Space Florida must obtain a Reentry Site Operator License from the FAA. Issuing a license is considered a major federal action subject to environmental review under NEPA. Under the Proposed Action, the FAA would issue a Reentry Site Operator License to Space Florida to operate the SLF as a commercial space reentry site. Space Florida is proposing to support up to a total of 17 reentries over the next 5 years (2021-2025), with a maximum of 6 reentries in any 1 year.

**PUBLIC REVIEW PROCESS:** In accordance with the applicable requirements, the FAA is initiating a public review and comment period for the Draft EA. The public comment period for the NEPA process begins with the publication of the Draft EA. Comments are due on December 7, 2020.

**CONTACT INFORMATION:** To submit comments on the Draft PEA please contact Ms. Stacey M. Zee, SLF PEA, c/o ICF International, 9300 Lee Hwy, Fairfax, VA 22031; [slfproject@icf.com](mailto:slfproject@icf.com).

This environmental assessment becomes a federal document when evaluated, signed, and dated by the responsible FAA official.

Responsible FAA Official:

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Date: October 26, 2020

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<sup>1</sup> CEQ amended its regulations implementing NEPA on September 14, 2020. Agencies have discretion to apply the amended regulations to NEPA processes that were begun before September 14, 2020 (40 CFR § 1506.13). FAA initiated its NEPA process for this action in 2019 and has decided not to apply the amended regulations. Therefore, the prior CEQ regulations continue to apply to this NEPA process.

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## ACRONYMS AND ABBREVIATIONS

### A

APE	Area of Potential Effects
ATC	Air Traffic Control

### B

### C

CCAFS	Cape Canaveral Air Force Station
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CDNL	C-weighted DNL

### D

dB	Decibel
dBc	C-weighted Decibel
DNL	Day-Night Level
DHR	Division of Historic Resources

### E

EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act

### F

FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FR	Federal Register
FWC	Florida Fish and Wildlife Conservation Commission

### G

### H

HUD	Housing and Urban Development
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### I

ISS	International Space Station
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### K

Km	Kilometer
KSC	Kennedy Space Center

### L

LOA	Letter of Agreement
LSOL	Launch Site Operator License

### M

MSL	Mean Sea Level
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### N

NAAQS	National Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOTAMS	Notices to Airmen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWS	National Weather Service

### O

### P

psf	Pounds per square foot
PEA	Programmatic Environmental Assessment

### Q

### R

RCS	Reaction Control System
RSOL	Reentry Site Operator License

**S**

SHPO	State Historic Preservation Office
SLF	Shuttle Landing Facility
SNC	Sierra Nevada Corporation
SPCC	Spill Prevention Control and Countermeasures
STOF	Seminole Tribe of Florida

**T**

TDAT	Tribal Directory Assessment Tool
TFR	Temporary Flight Restriction

**U**

UAV	Unmanned Vehicles
U.S.	United States
U.S.C.	United States Code
USAF	United States Air Force

USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USSF	United States Space Force

**V****W****X****Y****Z**

CHAPTER 1

# *INTRODUCTION*



Space Florida<sup>1</sup> is applying for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) (see **Figure 1-1**), located at the Cape Canaveral Spaceport<sup>2</sup>. Space Florida currently holds a Launch Site Operator License (LSOL) (License Number: LSO 18-018)<sup>3</sup> to operate the SLF<sup>4</sup>. Under the Proposed Action addressed in this Programmatic Environmental Assessment (PEA), the Federal Aviation Administration (FAA) would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF.

This PEA analyzes the impacts of the activities associated with Space Florida's RSOL programmatic document is a type of general, broad NEPA review from which subsequent NEPA documents can be tiered, focusing on the issues specific to the subsequent action (40 CFR § 1502.2).

If commercial vehicle operators apply to the FAA for reentry licenses to conduct reentry operations at the SLF, a separate environmental document, tiering off this PEA, would be developed to support the issuance of a reentry license to the prospective reentry operator(s). The tiered environmental document would be a more detailed analysis based on vehicle specific operations. Additional information on the programmatic environmental review process and how it applies to this project is provided in **Appendix C: Using this Programmatic EA to Tier Future NEPA Reviews**.

This PEA evaluates the potential direct, indirect, and cumulative environmental effects that may result from the Proposed Action described in **Chapter 2**. The successful completion of the environmental review process does not guarantee that the FAA would issue a RSOL to Space Florida. The Proposed Action must also meet FAA safety, risk, and financial responsibility requirements established in 14 CFR Part 400.

**Figure 1-2** shows a complete mission of a potential reentry vehicle. The SLF does not support vertical launches; therefore, launch activities for the reentry vehicle would occur at another FAA-licensed site under a separate license. The impacts of any reasonably foreseeable launch activities are covered in **Section 4.6 Cumulative Impacts**.

The launch site and launch vehicle operator require separate licenses to conduct a mission. This EA assumes the site operator and vehicle operator have the licenses, or other authorizations, to conduct a vertical launch at an approved launch site.

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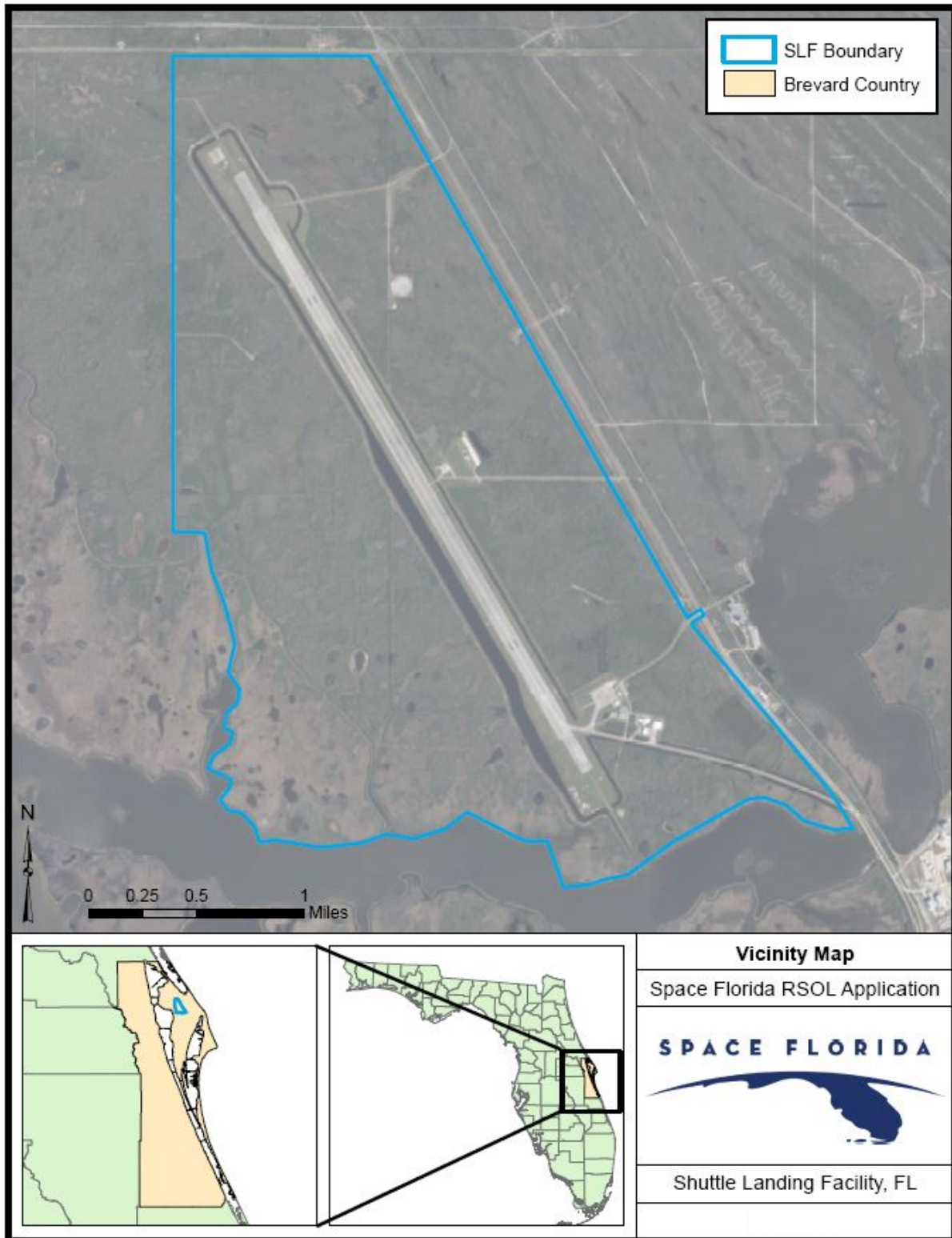
<sup>1</sup> As the State of Florida's aerospace economic development agency and spaceport authority, Space Florida is an independent Special District of the State of Florida, created by Chapter 331, Part II, Florida Statutes, for the purposes of fostering the growth and development of a sustainable and world-leading space industry in Florida.

<sup>2</sup> The Cape Canaveral Spaceport covers the same areas as the National Aeronautics and Space Administration's (NASA's) John F. Kennedy Space Center (KSC) and the Cape Canaveral Air Force Station (CCAFS). Florida Statute 331.304, states that CCAFS and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

<sup>3</sup> The 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) covers the Launch Site Operator License.

<sup>4</sup> In addition to the licensing requirements, Space Florida must also comply with their land agreement with NASA: *Kennedy Space Center Agreement 4412, Property Agreement between The National Aeronautics and Space Administration John F. Kennedy Space Center and Space Florida for the Transfer of Operations and Management of the Shuttle Landing Facility*.

**FIGURE 1-1: VICINITY MAP**



Source: (FAA, 2018)

**FIGURE 1-2: REENTRY VEHICLE OPERATION**

Source: (SierraNevadaCorporation, 2019)

## 1.1 BACKGROUND

Between 1984 and 2011, a total of 78 Space Shuttle orbiter landings occurred at the SLF located at Cape Canaveral Spaceport. During the last 20 years of the Space Shuttle program, landings at the SLF occurred at an average rate of four (4) per year, during years when the orbiter landed in Florida, and up to a maximum of eight (8) landings in 1997. Space Shuttle orbiter reentries and landings ceased in 2011 at the end of the Space Shuttle program. Starting in May 2017, the United States (U.S.) Air Force X-37B reentered and landed at the SLF, demonstrating the facility's continued ability to support orbital reentry and landing.

The FAA previously analyzed the potential environmental impacts of issuing a LSOL to Space Florida for the operation of a commercial space launch site at the SLF in the 2018 EA. The 2018 EA, which is hereby incorporated by reference, evaluated the potential environmental impacts of construction and operation of a commercial horizontal launch site at the SLF at Cape Canaveral Spaceport. The 2018 EA assessed Concept Y and Concept Z vehicles with annual launches ranging from 14 launches in 2018 to 74 launches by 2022. The FAA determined that issuing a LSOL, including construction and operation of the commercial launch site, would not significantly affect the quality of the human environment pursuant to Section 102(2)(c) of NEPA and issued a Finding of No Significant Impact (FONSI) on November 2, 2018.

The Proposed Action described in this PEA falls outside the scope of the 2018 EA because (1), the propellants and flight characteristics of the described reentry vehicle are different than the reusable

launch vehicles assessed in the 2018 EA (see **Section 2.1.1**) and (2), the proposed study area includes new areas over the state of Florida that were not analyzed in the 2018 EA (see **Chapter 3**). To focus this PEA on impacts specific to FAA's Proposed Action, valid and current information and analysis from the 2018 EA is summarized and incorporated by reference for relevant portions of the affected environment section (see Chapter 3 for more information). This PEA expands on the analysis provided in the 2018 EA to include an analysis of the potential environmental impacts of the operational activities associated with licensing the SLF as a commercial space reentry site. An electronic copy of the 2018 EA can be downloaded from the FAA website at:

[https://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/environmental/nepa\\_docs/review/documents\\_progress/space\\_florida/media/SLF\\_FONSI\\_ROD\\_and\\_Final\\_EA\\_with\\_Appendices\\_508\\_Compliant.pdf](https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/space_florida/media/SLF_FONSI_ROD_and_Final_EA_with_Appendices_508_Compliant.pdf)

The National Aeronautics and Space Administration (NASA) is currently assessing the potential environmental impacts of Space Florida developing Blocks 2 through 6 in the area around the SLF, to accommodate future SLF operations, capabilities, and supporting infrastructure. The proposed construction of SLF Blocks will be addressed separately through an Environmental Assessment beginning in 2020 for which NASA is the lead agency.

## 1.2 FEDERAL AGENCY ROLES

### 1.2.1 Lead Agency Role

As the lead Federal agency, the FAA is responsible for analyzing the potential environmental impacts of the Proposed Action and reasonable alternatives. The issuance of an RSOL would allow the activities described in this PEA to be conducted at the SLF. As authorized by Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities* (49 *Federal Register* 7099, 3 CFR, 1984 Comp., p. 163), and Chapter 509 of Title 51 of the U.S. Code, the FAA licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-Federal launch and reentry sites. The FAA's mission is to ensure public health and safety and the safety of property while protecting the national security and foreign policy interests of the U.S. during commercial launch and reentry operations. In addition, Congress directed the FAA to encourage, facilitate, and promote commercial space launches and reentries.

### 1.2.2 Cooperating Agency Roles

A cooperating agency is an agency, other than the lead agency, that has jurisdiction by law or special expertise regarding any environmental impact resulting from a proposed action or reasonable alternative. NASA, U.S. Space Force (USSF), U.S. Fish and Wildlife Service (USFWS), and the National Park Service (NPS) are cooperating agencies for this PEA due to their special expertise and jurisdictions (40 CFR §§ 1508.15 and 1508.26). The cooperating agencies and the roles of these agencies have not changed from the 2018 EA.<sup>5</sup>

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<sup>5</sup> The USSF was established in 2019 within the Department of the Air Force. The Secretary of the Air Force has overall responsibility for the USSF under the Secretary of Defense (USAF, 2020).

### 1.3 PURPOSE AND NEED

The purpose and need provides the foundation for identifying intended results or benefits and future conditions. In addition, the purpose and need defines the range of reasonable alternatives to a proposed action.

The purpose of Space Florida's proposal is to expand the capabilities at the SLF by obtaining an RSOL from the FAA to support commercial space reentry vehicle operations. Commercial space transportation companies, such as Sierra Nevada Corporation and its Dream Chaser vehicle, have contacted and coordinated with Space Florida for the use of the SLF. The new capabilities would include the establishment of reentry corridors and recovery and post processing operations for horizontally landed reentry vehicles, such as the Dream Chaser.

Space Florida's need for the RSOL is to further the State's goals to support economic activity that was negatively impacted by the termination of the NASA Space Shuttle program in July 2011. Space Florida's Proposed Action, as described in **Chapter 2**, would promote and encourage commercial reentry vehicle operators to use the SLF for horizontal landings. For example, Sierra Nevada's future Dream Chaser missions will be in support of a contract with NASA for resupply of the International Space Station. These missions are purchased by NASA to provide a commercial resupply service, but Dream Chaser remains owned and operated by Sierra Nevada Corporation. This relationship allows the vehicle to be used to support additional missions for other government and non-government customers. These missions, by Dream Chaser and/or other horizontal vehicles, could include experiments, space tourism, for-profit reentry services, or other related commercial space activities.

### 1.4 AGENCY INVOLVEMENT

The agency involvement for the PEA followed the same process conducted for the 2018 EA. Space Florida distributed early coordination letters to various federal, state, and local agencies. The FAA consulted with Native American Tribes and Florida State Division of Historic Resources (the State Historic Preservation Office) describing Space Florida's Proposed Action to obtain a RSOL at the SLF.

See **Appendix A** for the early coordination letters and list of agencies and Native American Tribes contacted for this PEA. During the early coordination efforts, the following agencies provided comments:

- » U.S. Environmental Protection Agency
- » City of Titusville – Planning
- » Florida Department of Environmental Protection State Clearinghouse

### 1.5 PUBLIC INVOLVEMENT

The FAA will use the FAA's Office of Commercial Space Transportation NEPA website for outreach and communication on the Draft PEA ([https://www.faa.gov/space/environmental/nepa\\_docs/](https://www.faa.gov/space/environmental/nepa_docs/)). The FAA released this Draft PEA for a 30-day public review. The FAA provided public notice of the availability of the Draft PEA for public review and comment through the *Federal Register*, and local newspaper advertisements.



Questions on the preparation of the Draft PEA may be addressed to Ms. Stacey Zee, SLF PEA c/o ICF, 9300 Lee Hwy, Fairfax, VA 22031 or submitted by email to [slfproject@icf.com](mailto:slfproject@icf.com). Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

The FAA invites interested government agencies, organizations, Native American tribes, and members of the public to submit comments on any aspect of this Draft PEA. Following the close of the public comment period, the FAA will revise the PEA, as appropriate, in response to comments received on the draft document, and a Final PEA will be prepared. The Final PEA will reflect the FAA's consideration of comments and will provide responses to substantive comments. Following review of the Final PEA, the FAA will either issue a FONSI or decide to prepare an Environmental Impact Statement (EIS).

CHAPTER 2

*PROPOSED ACTION / ALTERNATIVES*

This chapter describes the Proposed Action considered in this Draft PEA. This chapter also describes a No Action Alternative. FAA Order 1050.1F, Paragraph 6-2.1 states, “An EA may limit the range of alternatives to the proposed action and no action alternative when there are no unresolved conflicts concerning alternative uses of available resources.” In the absence of unresolved conflicts (**Chapter 4** provides detailed descriptions as to why there are no unresolved conflicts), the consideration of other alternatives to avoid or minimize potential effects are not warranted. Therefore, the No Action Alternative and Proposed Action described and analyzed in this PEA represent the range of reasonable alternatives commensurate with the nature of the project.

## 2.1 PROPOSED ACTION

This PEA expands on the analysis provided in the 2018 EA to include analysis of the potential environmental impacts of the FAA issuing Space Florida an RSOL to operate a commercial space reentry site at the SLF and support orbital reentries. This PEA also analyzes operations associated with the reentry vehicles, including the Dream Chaser vehicle, including the reentry flight path, landing, and recovery activities, which are described in the subsections below.

Applicants proposing to reenter and land at the SLF would prepare a separate environmental document that is tiered off this PEA to support their reentry operator application. This subsequent tiered EA would include details on the proposed vehicle and reentry operations and associated activities.

Under the Proposed Action, the reentry site boundary is defined as the property boundary of the SLF as shown in **Figure 1-1**.

### 2.1.1 Reentry Vehicle

**Table 2-1** summarizes the reentry vehicle parameters. The purpose of describing these parameters is to broadly assess the potential impacts of reentry vehicle operations at the SLF. The reentry vehicle parameters considered in this PEA are based on the existing Sierra Nevada Corporation (SNC) *Dream Chaser*® spacecraft, shown in **Figure 2-1**.

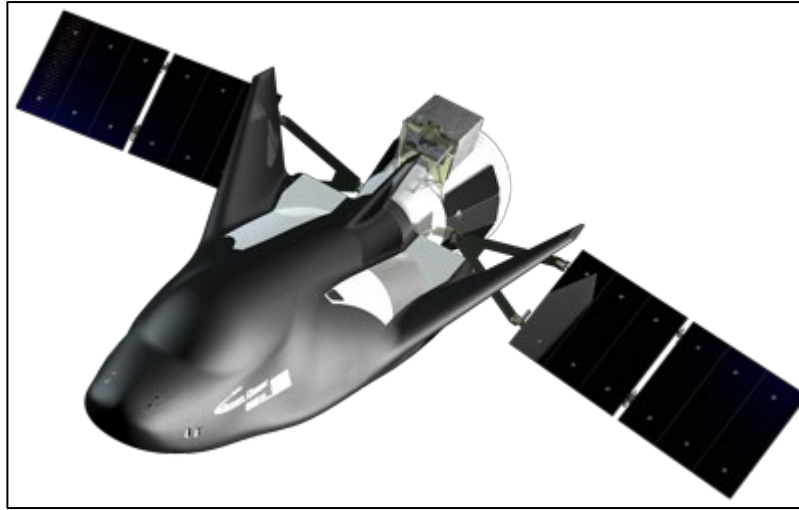
**TABLE 2-1: REENTRY VEHICLE PARAMETERS**

Characteristic	Data
Vehicle Length	30 ft
Wingspan	27 ft
Gross Vehicle Weight	24,600 lbs
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 ft
Cross-Range Capability	± 700 nmi
Propellants <sup>1</sup>	Hydrogen Peroxide (H <sub>2</sub> O <sub>2</sub> ) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

<sup>1</sup> Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground.

Source: (SierraNevadaCorporation, 2019)



**FIGURE 2-1: REENTRY VEHICLE**

Note- this picture represents the configuration of the vehicle when in orbit.  
Source: (SierraNevadaCorporation, 2019)

The Dream Chaser is owned and operated by SNC. Dream Chaser missions are, in part, to support a NASA/SNC contract to resupply the International Space Station (ISS). NASA purchases these missions to provide a commercial resupply service, thus allowing the vehicle to be used to support additional missions for other government and non-government customers. If SNC applies to the FAA for a reentry license, SNC would prepare a separate EA, tiered off this PEA, for the FAA's review.

#### 2.1.1.1 Pre-Flight Activities

The pre-flight activities that are relevant to environmental concerns include:

- notifying Space Florida before a launch of a vehicle that intends to land at the SLF,
- coordinating all operations with the control tower chief, and
- notifying other appropriate scheduling agencies in accordance with Space Florida's Scheduling and Notification Plan.

Designated Space Florida personnel would notify the reentry operator of other activities at the SLF and resolve potential conflicts for use. Space Florida would also work with the KSC Spaceport Integration Office to ensure that planned reentries would not interfere with NASA, USFWS, USSF, NPS, National Security Agency, National Geospatial-Intelligence Agency, National Oceanic and Atmospheric Administration, or other commercial operations.

#### 2.1.2 Pre-Reentry Activities

Following procedures and plans outlined in the LSOL and RSOL, flight and ground crews would be trained for nominal and non-nominal operations before each reentry, and training would be repeated with various failure scenarios and irregular performance to ensure crew readiness.

### 2.1.3 Reentry Vehicle Flight Paths

This section describes the representative reentry vehicle flight paths used to assess the potential environmental impacts of Space Florida’s RSOL. Specific vehicle flight paths for prospective reentry vehicle operators would be assessed in separate NEPA documents tiered from this PEA (for more information, see **Appendix C**).

The reentry vehicle would reenter from west/southwest on an ascending reentry trajectory before landing at the SLF. Ascending reentry trajectories would include high atmospheric overflight of Central American countries as well as overflight of the southern half of Florida, south of 29° North latitude.

The reentry vehicle would descend below 60,000 feet altitude above mean sea level (MSL) approximately 30-40 miles from the SLF prior to landing and would be operating below 60,000 MSL for less than 30 seconds before entering Cape Canaveral Restricted Airspace. The reentry vehicle would remain in the Cape Canaveral Restricted Airspace for the remainder of its reentry and landing at the SLF (for approximately 2.5 – 3 minutes). The FAA would issue Temporary Flight Restrictions (TFRs) for the reentry vehicle’s operation outside of the Cape Canaveral Restricted Airspace as described in the reentry vehicle operator’s Letter of Agreement (LOA) with FAA Air Traffic Control. If reentry vehicle operators apply to the FAA for a reentry vehicle license, operator-specific TFRs would be discussed in subsequent tiered NEPA documents from this PEA.

There is a potential for aircraft hazard areas to extend outside of the Cape Canaveral Restricted Airspace. Specific aircraft hazard areas will be considered as part of tiered NEPA analyses for specific reentry vehicles.

The reentry vehicle’s trajectories over Florida for landings on Runway 15 and Runway 33 are shown in **Figure 2-2** and **Figure 2-3**.

#### 2.1.4 Proposed Reentry Operations

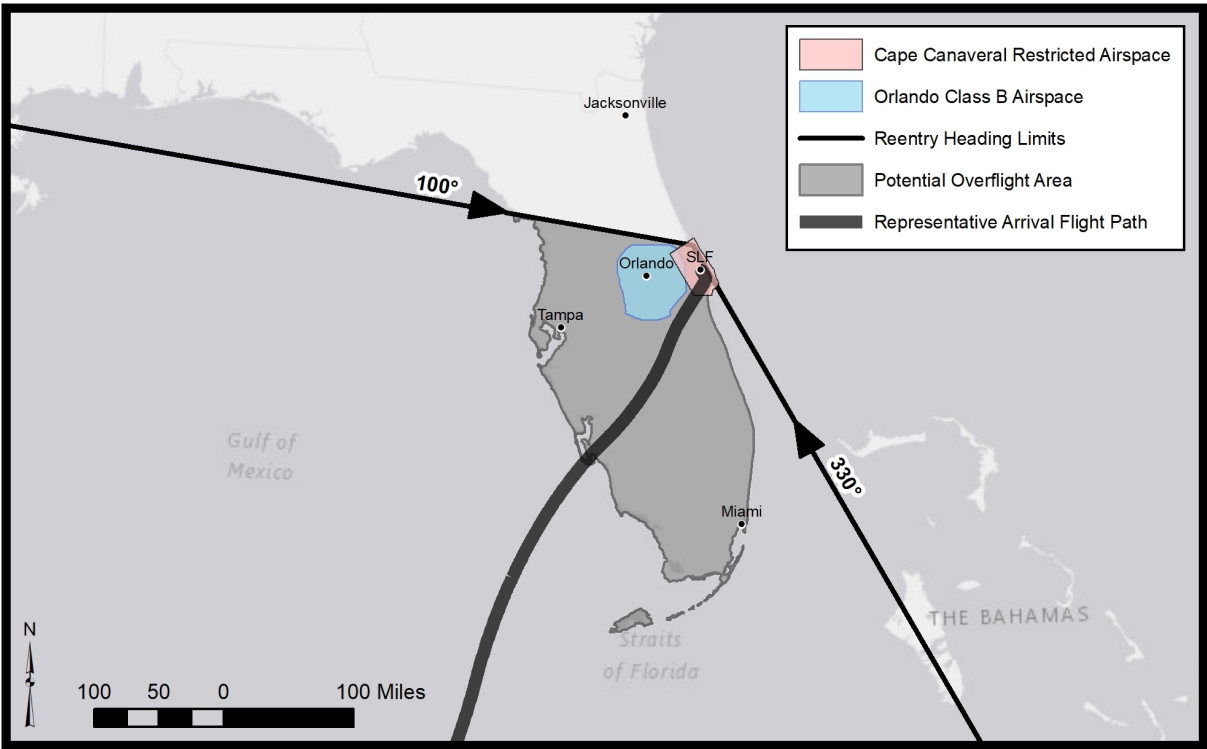
Space Florida anticipates up to 6 reentries a year (4 daytime and 2 nighttime) with a steady ramp-up beginning in 2021 (see **Table 2-2**). The reentry vehicle’s cargo module would be disposed of during reentry and any surviving debris would be intentionally placed in a remote part of the Pacific Ocean in compliance with the regulations set forth in Part 435 and coordinated through the reentry vehicle license and resulting FAA Air Traffic and U.S. Coast Guard LOAs. Based on flight safety analysis conducted in developing their license application, Space Florida anticipates that there are no areas within the State of Florida that will exceed individual risk criteria limits. Therefore, Space Florida does not expect the operation of reentry vehicles to the SLF to require any closures of non-involved KSC property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

**TABLE 2-2: ESTIMATED ANNUAL NUMBER OF REENTRIES**

Vehicle	2021	2022	2023	2024	2025
Reentry Vehicle	1	2	3	5	6

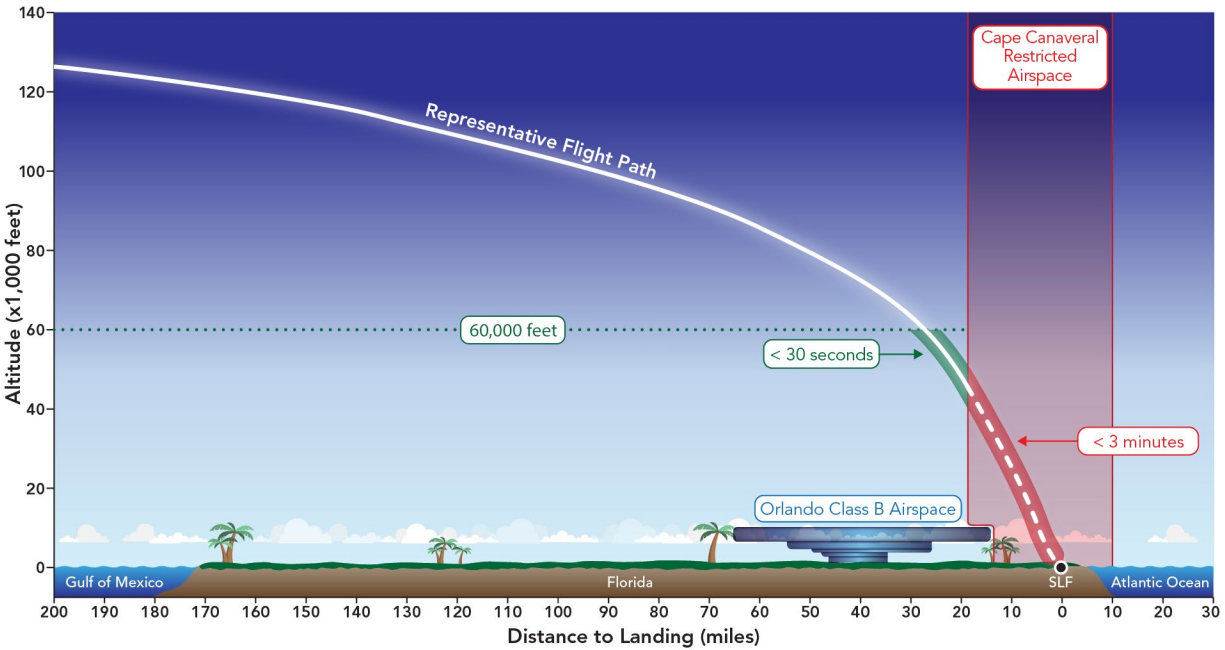
Source: (SpaceFlorida, 2019)

FIGURE 2-2: REENTRY VEHICLE FLIGHT PATH APPROACHES



Source: (SierraNevadaCorporation, 2019)

FIGURE 2-3: REENTRY VEHICLE REPRESENTATIVE FLIGHT PATH



Source: (SNC, Kimley Horn, 2020)

### 2.1.5 Post-Reentry Propellant Handling and Procedures

Propellant handling operations, following landing and wheel-stop, and unloading of cargo would follow procedures that are dependent on the cargo manifest needs.

This PEA presents the potential procedures operators would conduct to process their reentry vehicle. The first activity following landing is to approach and begin safing the reentry vehicle on the runway. This can include disengaging and locking out the propulsion systems, aerodynamic systems, pressurized systems, braking systems, and other safety checks for the safe handling of the reentry vehicle. The reentry vehicle operator would unload time-critical cargo (if necessary) and then tow the vehicle to a designated location, as defined in the explosive site plan. At that time, all residual propellants are removed or diluted (as required), offloaded into approved storage containers, and are transported and disposed of in an approved method.

Runway 15/33 is unavailable to other operations/activities while the reentry vehicle is stopped on the runway. After the reentry vehicle is removed from the runway, Space Florida would perform a runway inspection to ensure the safety of reopening the runway to other aircraft/spacecraft. Lastly, the reentry vehicle is prepped for transportation back to its home facility. This includes placing the reentry vehicle into a transportation safe configuration. This may include loading onto a transport fixture, folding the wings, stowing the landing gear, and/or protection of sensitive surfaces.

Space Florida and reentry vehicle operators may employ 10 to 40 people for post-reentry procedures. This could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the number and type of operations.

## 2.2 NO ACTION ALTERNATIVE

NEPA requires agencies to consider a “no action” alternative in their NEPA analyses and to compare the effects of not taking action with the effects of the action alternative(s). Thus, the No Action Alternative serves as a baseline to assess the comparative impacts of the action alternative(s), including the Proposed Action. Under the No Action Alternative, the FAA would not issue an RSOL to Space Florida. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022).

If Space Florida does not acquire an RSOL, the Space Florida business model, as briefed to the State, would no longer be viable and would require reevaluation of management of the SLF. Space Florida would not be able to sponsor the permitted and priority use for commercial space operation as identified in the NASA Use Permit.<sup>6</sup> Furthermore, NASA has contracted with commercial companies, such as SNC, to provide commercial resupply with the requirement of landing at the SLF. Given the commercial

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<sup>6</sup> Space Florida promotes economic development activities for space industry needs, including attracting, retaining, and expanding aerospace or supply chain businesses that create economic opportunities in Florida. Space Florida responded to a NASA request, or, Notice of Availability for proposals to operate and manage the SLF. In 2013, the NASA selected Space Florida to manage and operate the SLF. In June 2015, Kennedy Space Center transferred the management, development, and operation of the SLF to Space Florida.

designation of the mission in the contract between SNC and NASA, FAA licenses are required by both the vehicle operator and the site in order to conduct missions. The No Action Alternative would prohibit the execution of the contract in support of NASA ISS resupply. Existing operations would continue at the SLF.

The No Action Alternative would not satisfy the FAA's need to fulfill its responsibilities under EO 12465 and Chapter 509 of Title 51 of the U.S. Code for oversight of commercial space launch activities and would not satisfy Space Florida's need to further the State's goals to support economic activity that was negatively impacted by the termination of the NASA Space Shuttle program in July 2011. This need is also consistent with direction in the National Space Transportation Policy (November 21, 2013).

CHAPTER 3

*AFFECTED ENVIRONMENT*

This chapter provides a description of the geographic area that the Proposed Action may affect as required by FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

The study area for this PEA is the geographic area that could be directly or indirectly affected by the Proposed Action. The Proposed Action would not result in ground disturbing activities or directly affect the Shuttle Landing Facility (SLF). Therefore, the study area for this PEA is based on the composite of landings on Runway 15 or Runway 33 and the resulting combined footprint of the reentry vehicle's 1.0 pounds per square foot (or psf) sonic boom noise contour as it descends to land at the SLF (see **Section 3.4** for further description about how the sonic boom was calculated). The study area encompasses about 280 square miles including portions of Brevard and Volusia counties and extends over a portion of the Atlantic Ocean (see **Figure 3-1**).

The Proposed Action in the PEA is not expected to result in impacts to several environmental categories described below. Although the study area in this PEA is not the same as the study area in the 2018 EA, they are located in the same two counties and the affected environment is expected to be similar. Therefore, per Section 1502.21 of the CEQ Regulations, this PEA incorporates by reference from the 2018 EA the environmental analyses relevant to the below impact categories:

- **Air Quality:** There would be no combustion from reentry vehicles once the deorbit burn completes, so the Proposed Action would not significantly affect air quality.
- **Climate:** There would be no combustion from reentry vehicles once the deorbit burn completes, so the Proposed Action would not significantly affect climate.
- **Coastal Resources:** The Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of the Florida Coastal Management Program and would not adversely affect coastal resources, create plans to direct future agency actions, propose rulemaking that alters uses of the coastal zone that are inconsistent with the Program, or involve Outer Continental Shelf leases.
- **Farmland:** The operation of reentry vehicles would not disturb soils, nor would the operations significantly effect air quality, water quality, or noise in a way that may affect farmlands. For more information on noise impacts, see **Section 3.4** and **4.4**,
- **Hazardous Materials, Pollution Prevention, and Solid Waste:** Operations at the SLF would involve the use and storage of hazardous materials that are similar to those currently handled at the SLF. Significant quantities of additional hazardous materials would not be permanently stored onsite. Under the Proposed Action, hazardous material use, storage, and disposal would comply with applicable regulations, thus minimizing the potential effects from those materials. Due to the limited number of reentries under the Proposed Action, the increase in hazardous waste generation would be minimal.
- **Land Use:** Reentry vehicle operations would be compatible with the existing operations that occur at the SLF, so the Proposed Action would not significantly impact land use.
- **Natural Resources and Energy Supply:** Reentry vehicle operations would not place excessive demands on local supplies of natural resources, fuel, or energy. Therefore, the Proposed Action would not significantly impact Natural Resources and Energy Supply.

- **Visual Effects (including Light Emissions):** As required by NASA, lighting that is visible from the exterior of the proposed facilities would comply with the KSC Exterior Lighting Guidelines, the LMP, and requirements of the USFWS Biological Opinion for KSC impacts to threatened and endangered species. The operation of reentry vehicles at the SLF would be visually similar to aircraft currently operating at the SLF. Therefore, the Proposed Action would not cause significant impacts from light emissions or visual effects.
- **Water Resources:** Operation of reentry vehicles and facilities would not affect wetlands. The measures required by Space Florida's NPDES permit, Environmental Resources Permit, SPCC Plan, and the SLF emergency spill plan would ensure the Proposed Action would not cause surface water quality impacts which would exceed applicable water quality standards, or contaminate public drinking water supplies. The Proposed Action does not include develop or construction activities and would therefore not impact floodplains or groundwater. Therefore, the Proposed Action would not significantly impact water resources.

This chapter describes in detail only those environmental impact categories that have the potential to be affected by the Proposed Action; which include:

- **Section 3.1-** Biological Resources (including fish, wildlife, and plants)
- **Section 3.2-** Department of Transportation Act, Section 4(f)
- **Section 3.3-** Historical, Architectural, Archaeological, and Cultural Resources
- **Section 3.4-** Noise and Noise-Compatible Land Use
- **Section 3.5-** Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

This information establishes a baseline for use in determining the potential effects of the Proposed Action and No Action Alternative.

### 3.1 BIOLOGICAL RESOURCES

The study area encompasses a variety of habitats ranging from developed land to undeveloped forested land and aquatic environments. Federally listed and/or state-listed threatened or endangered species may use these habitats. **Table 3-1** lists the federally listed and state-listed threatened and endangered species that the U.S. Fish and Wildlife Service (USFWS) and Florida Fish and Wildlife Conservation Commission (FWC) identify as having the potential to occur in the counties within the study area.

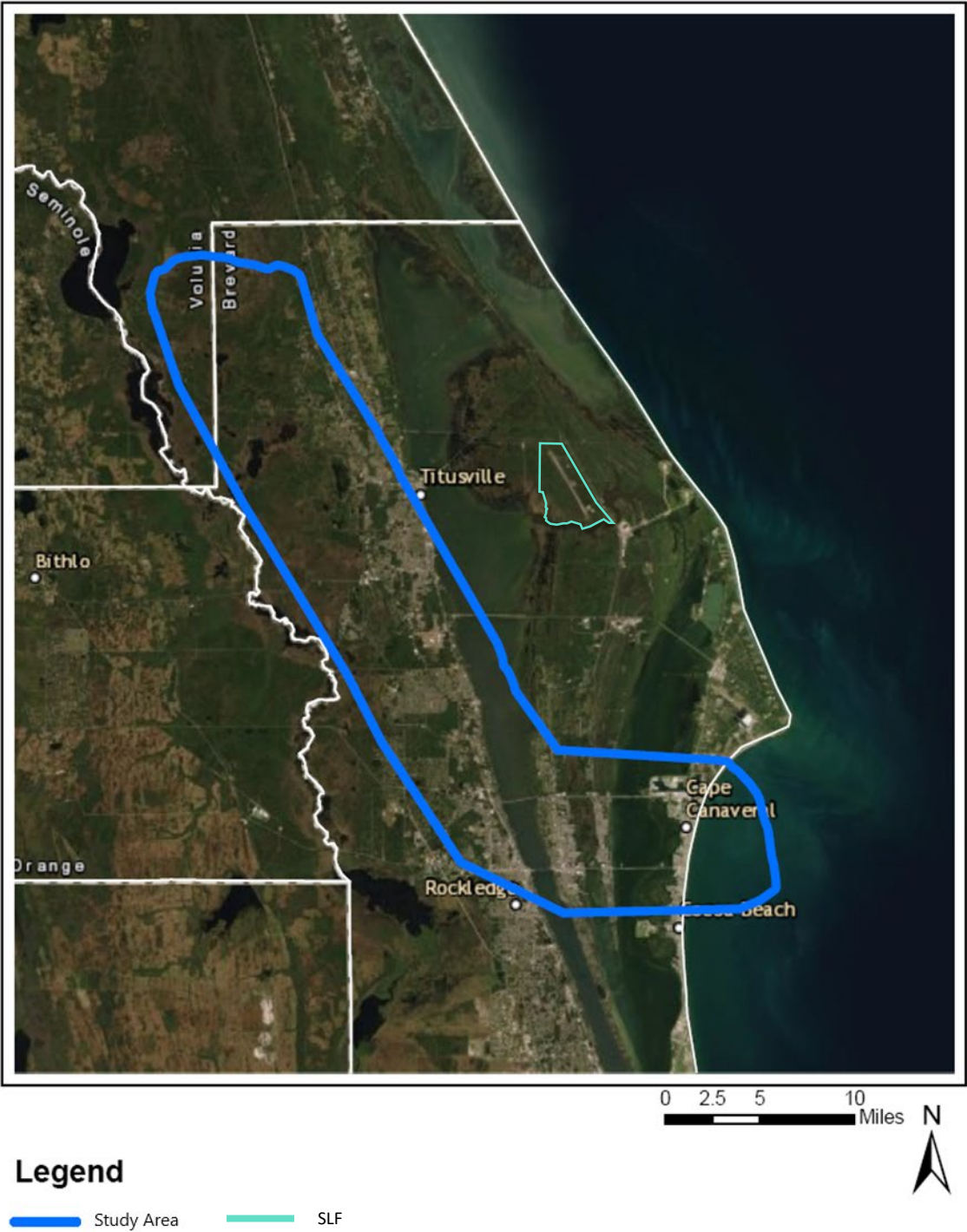
Bald eagles, protected by the Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668 et seq.), have been observed in the study area. There are 23 known active bald eagle nests within the study area (see **Figure 3-2**). **Figure 3-2** reflects 2019 conditions; therefore, there could be additional bald eagle nests in the area. Golden eagles are not present in the study area.

The study area also intersects areas designated as Marine Protected Areas of the Merritt Island National Wildlife Refuge (NWR) and critical habitat for the West Indian Manatee (USFWS, 2016b).

The Proposed Action would have no effect on plants of any kind because there are no ground-disturbing activities. Therefore, given the lack of impacts, plant species are not included in **Table 3-1**.



FIGURE 3-1: STUDY AREA



**RS&H**

Source: (ESRI, 2019) (RS&H, 2019)

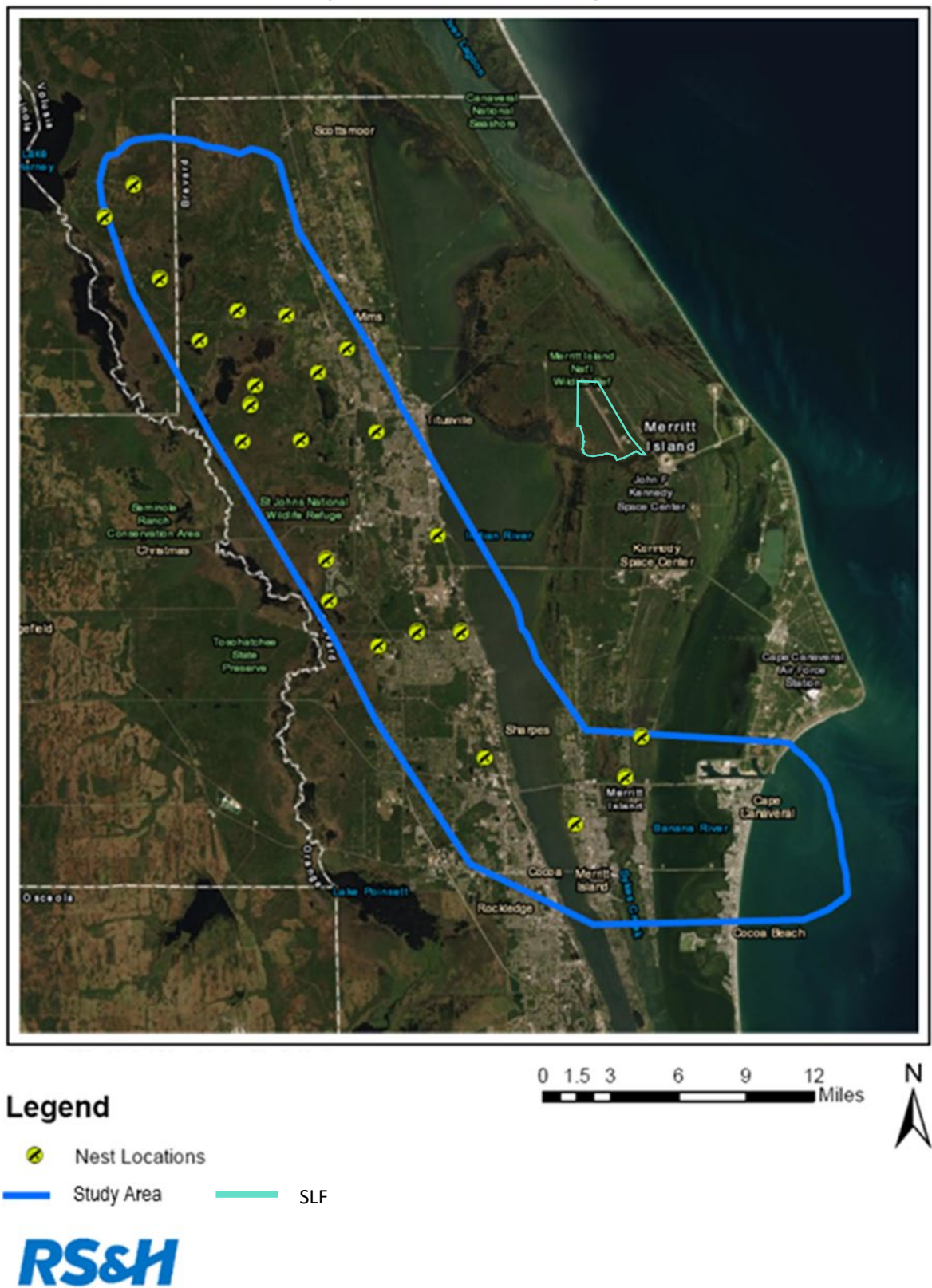
**TABLE 3-1: FEDERALLY LISTED AND STATE-LISTED THREATENED AND ENDANGERED SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA**

Common Name (Scientific Name)	Federal Status	State Status
<b>Birds</b>		
Audubon's Crested Caracara ( <i>Polyborus plancus audubonii</i> )	Threatened	Threatened
Eastern Black Rail ( <i>Laterallus jamaicensis ssp. jamaicensis</i> )	Proposed	Proposed
	Threatened	Threatened
Everglades Snail Kite ( <i>Rostrhamus sociabilis plumbeus</i> )	Endangered	Endangered
Florida Sandhill crane ( <i>Grus canadensis pratensis</i> )	N/A	Threatened
Florida scrub-jay ( <i>Aphelocoma coerulescens</i> )	Threatened	Threatened
Least tern ( <i>Sternula antillarum</i> )	N/A	Threatened
Piping Plover ( <i>Charadrius melodus</i> )	Threatened	Threatened
Red Knot ( <i>Calidris canutus rufa</i> )	Threatened	Threatened
Red-Cockaded woodpecker ( <i>Picoides borealis</i> )	Endangered	Endangered
Southeastern American kestrel ( <i>Falco sparverius paulus</i> )	N/A	Threatened
Wood stork ( <i>Mycteria americana</i> )	Threatened	Threatened
Black skimmer ( <i>Rynchops niger</i> )	-	Threatened
Little blue heron ( <i>Egretta caerulea</i> )	-	Threatened
Reddish egret ( <i>Egretta rufescens</i> )	-	Threatened
Roseate spoonbill ( <i>Platalea ajaja</i> )	-	Threatened
Snowy plover ( <i>Charadrius nivosus</i> )	-	Threatened
Tricolored heron ( <i>Egretta tricolor</i> )	-	Threatened
Florida burrowing owl ( <i>Athene cunicularia floridana</i> )	-	Threatened
<b>Mammals</b>		
Southeastern Beach Mouse ( <i>Peromyscus polionotus niveiventris</i> )	Threatened	Threatened
West Indian Manatee ( <i>Trichechus manatus</i> )	Threatened	Threatened
North Atlantic Right Whale ( <i>Eubalaena galcialis</i> )	Endangered	-
<b>Reptiles</b>		
Atlantic Salt Marsh Snake ( <i>Nerodia clarkia taeniata</i> )	Threatened	Threatened
Eastern Indigo snake ( <i>Drymarchon corais couperi</i> )	Threatened	Threatened
Gopher Tortoise ( <i>Gopherus polyphemus</i> )	Candidate	Threatened
Green sea turtle ( <i>Chelonia mydas</i> )	Threatened	Endangered
Hawksbill sea turtle ( <i>Ertmochelys imbricata</i> )	Endangered	Endangered
Kemp's Ridley sea turtle ( <i>Lepidochelys kemnoil</i> )	Endangered	Endangered
Leatherback sea turtle ( <i>Dermochelys coriacea</i> )	Endangered	Endangered
Loggerhead Sea Turtle ( <i>Caretta caretta</i> )	Threatened	Threatened
<b>Fish</b>		
Smalltooth Sawfish ( <i>Pristis pectinate</i> )	Endangered	-

Note: N/A = species is not federally listed as threatened or endangered, or species is federally listed as threatened or endangered but has been determined to not be in study area based on USFWS threatened and endangered species county lists.

Sources: (Florida Natural Areas Inventory, 2019) (USFWS, 2019) (FWC, 2018)

FIGURE 3-2: BALD EAGLE NESTS (APPROXIMATE LOCATION) IN THE STUDY AREA



Source: (ESRI, 2019) (RS&H, 2019) (FWC, 2019)

### 3.2 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F)

Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966, Section 4(f), now codified as 49 U.S.C. § 303(c), protects significant publicly owned parks, recreation areas, wildlife and waterfowl refuges, and public and private historic sites. The term historic resource includes prehistoric and historic districts, sites, buildings, structures, or objects listed in, or eligible for listing in, the National Register of Historic Places (NRHP) (see **Section 3.3** for further details). The FAA is the ultimate decision maker for Section 4(f) determinations but is also responsible for soliciting and considering the comments of the official(s) with jurisdiction over Section 4(f) properties.

**Figure 3-3** shows the location of the cooperating agency management area boundaries in the study area. As listed in **Table 3-2**, the study area includes over 50 parks, conservation areas, wildlife management areas, and sanctuaries. The two national wildlife refuges within the study area are described in more detail below. **Figure 3-4** shows the National Wildlife Refuges in study area.

#### 3.2.1 Merritt Island National Wildlife Refuge

The purposes of Merritt Island NWR stem from the Migratory Bird Conservation Act (16 USC §715d, §715i), the North American Wetlands Conservation Act [16 USC §4401(2)(b)], and Public Law 93-626 [16 USC §459(j)]. The purposes of Merritt Island NWR include conservation, protection, and management of migratory birds, threatened and endangered species, and wildlife and habitat diversity; preservation and protection of outstanding natural, scenic, scientific, ecologic, and historic values; and providing for outdoor recreation use and enjoyment.

While operational areas of Kennedy Space Center (KSC), including the SLF, are not under USFWS management, USFWS does respond to certain natural resource issues in those areas in accordance with KCA-4412, *Property Agreement between the National Aeronautics and Space Administration John F. Kennedy Space Center and Space Florida for the Transfer of Operations and Management of the Shuttle Landing Facility* between Space Florida and NASA KSC, in consultation with the USFWS.

Merritt Island NWR management activities in and around the study area include managing wildland fire, conducting prescribed burns, conducting mechanical habitat management activities, controlling non-native plants and animals, conducting wildlife and habitat survey and inventory activities, and providing opportunities for wildlife-oriented public use activities. These, along with other activities, are further described in the Comprehensive Conservation Plan of Merritt Island NWR. Merritt Island NWR has an annual visitation of over 1.6 million people.

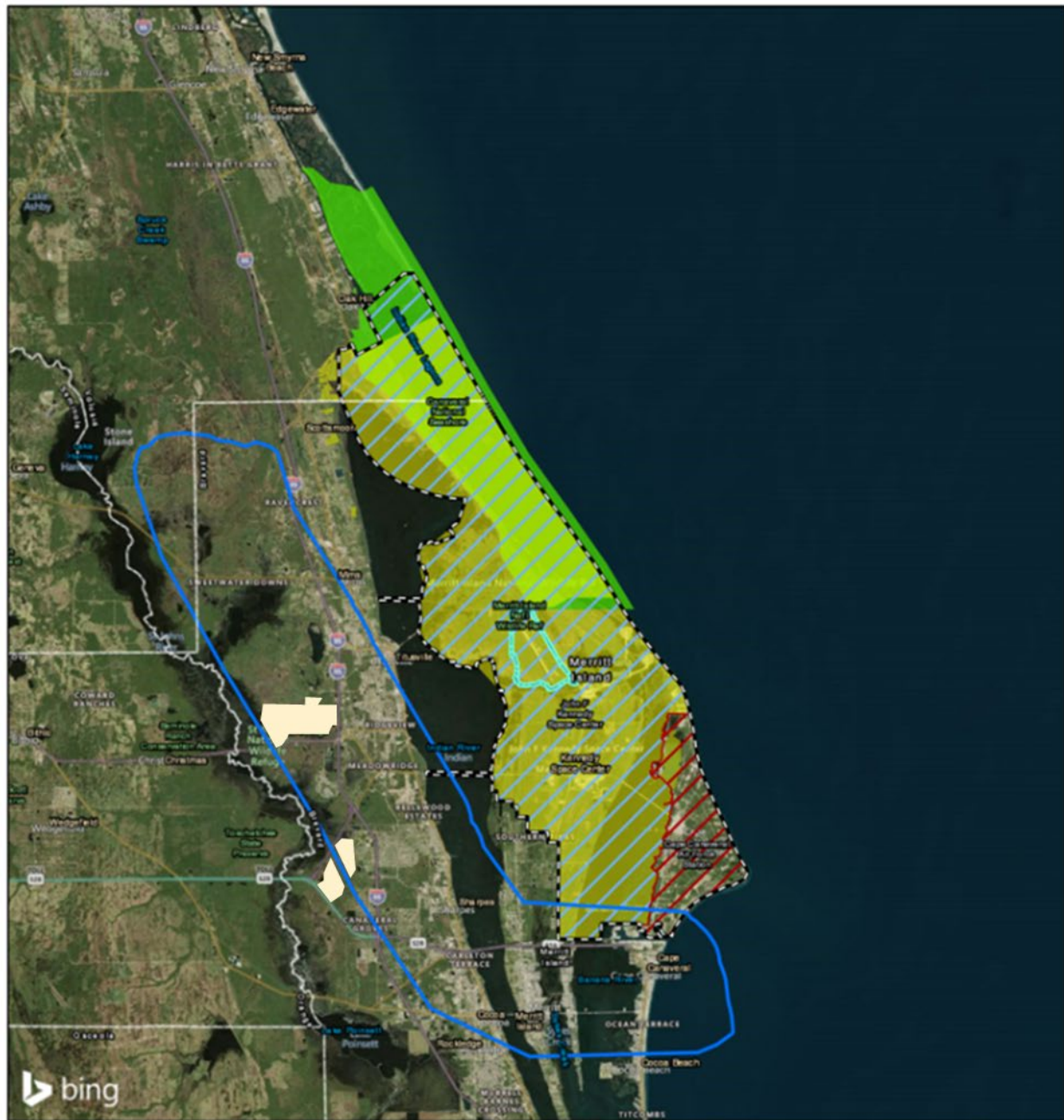
The Merritt Island NWR is also part of the Great Florida Birding and Wildlife Trail, which is a network of 510 wildlife viewing sites across the state (Fish & Wildlife Foundation of Florida Inc., 2015).



**TABLE 3-2: PARKS, CONSERVATION AREAS, WILDLIFE MANAGEMENT AREAS, AND SANCTUARIES IN THE STUDY AREA**

Resource Name	Resource Name
Banana River Park	Lee Wenner Park
Bird Lake Marsh	McFarland Park
Bird Lake Marsh	Manatee Sanctuary Park
Blue Heron Water Reclamation Facility & Wetland Area	Manatee Cove Park
Bracco Park	Merritt Island National Wildlife Refuge
Cameron Barkley Rotary Memorial Park	Mitchell Ellington Park
Canaveral Marshes Conservation Area	Nicol Park
Canaveral City Park	Pineda Park
Carl E Anderson Park	Pineview Park
Center Street Park	Provost Park
Chain of Lakes Park	Port St. John Boat Ramp
Cherie Down Park	Osteen Park
Cocoa Ocean Beach	River Lakes Conservation Area
Danny Strickland Park	Riverfront Park
Don Mo Stradley Memorial Park	Rodney S. Ketcham Park
Enchanted Forest Sanctuary	Rotary Park Merritt Island
Fay Park	St Johns National Wildlife Refuge
Fox Lake Park	Salt Lake Wildlife Management Area
Friendship Park	Seminole Ranch Conservation Area
Harry and Harriette Moore Memorial Park	Shepard Park
Hatbill Park	Stuart Park
Holder Park	Travis Park
Intercoastal Waterway Park	Taylor Park
Jetty Park	Ulumay Wildlife Sanctuary
Jim Hensley Park	Veterans Memorial Park
Joe Lee Smith Park	Waterway Park
Junny Rios Martinez Park	Watts Park
Kelly Park	William J Menzo Park
Kennedy Point Park	Woody Simpson Park
Kings Park	Wuesthoff Park
Lori Wilson Park	W.W. James Park

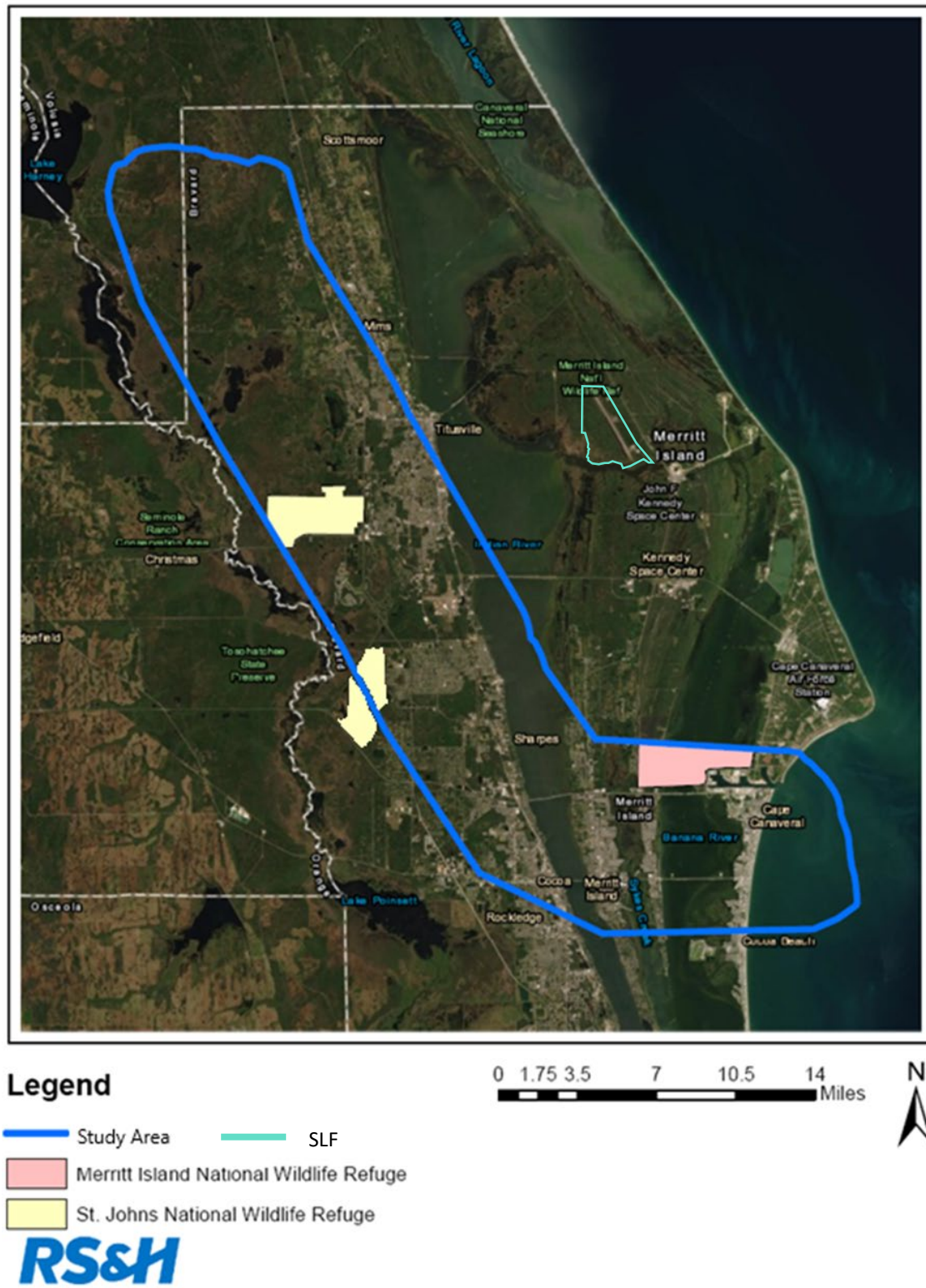
Sources: (Brevard, 2019) (USFWS, National Wildlife Refuge, 2019) (FWC, 2019) (Florida, 2019) (Cocoa, 2019) (Beach, 2019).

**FIGURE 3-3: COOPERATING AGENCY MANAGEMENT AREA BOUNDARIES****Legend**

- Study Area
- - - SLF
- - - Cape Canaveral Spaceport
- ▨ Kennedy Space Center
- ▨ Canaveral National Seashore and Merritt Island National Wildlife Refuge Overlap
- ▨ Cape Canaveral Air Force Base
- Merritt Island National Wildlife Refuge
- Canaveral National Seashore
- St. Johns NWR

Source: (RS&H, 2019) (Bing, 2019) (FAA, 2018) (USFWS, 2019)

FIGURE 3-4: NATIONAL WILDLIFE REFUGES IN STUDY AREA



### 3.2.2 St. Johns National Wildlife Refuge

The St. Johns NWR was established in 1971 and protects 19 federal and state listed species. The purposes of St. Johns NWR stem from the Endangered Species Act (16 USC §1534) and the National Wildlife Refuge System Administration Act [16 USC §668d(a)(2)]. The purposes of St. Johns NWR include conservation of threatened and endangered species and conservation, management, and restoration of wildlife and habitat for future generations. The St. Johns NWR refuge is managed primarily through prescribed burning to maintain habitat for many species classified as threatened, endangered and species of special concern. Waterfowl use is primarily blue-winged teal and ring-necked ducks. Greater and lesser yellowlegs, blacknecked stilts and killdeer are also seen. Turkey and black vultures frequent the area, as well as occasional hawks (USFWS, 2019).

## 3.3 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act requires a federal agency to consider the effects of its undertaking on historic properties in accordance with 36 CFR Part 800. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and other parties, including Indian tribes.

Historic, architectural, and cultural resources are sites recorded by the Florida Division of Historical Resources as Florida historical markers or resources that are in or eligible for listing in the National Register of Historic Places (NRHP).

### 3.3.1 Area of Potential Effects

In accordance with 36 CFR § 800.4(a)(1), the FAA has established an Area of Potential Effects (APE) for the proposed undertaking (i.e., Proposed Action). The FAA determined an APE in consideration of potential effects to historic properties from implementation of the Proposed Action. The Proposed Action does not include ground-disturbing activities; therefore, archaeological resources are not considered in this PEA, and the APE is the same as the study area and encompasses the sonic boom footprint (see **Section 4.4**).

### 3.3.2 Section 106 Consultation

The FAA initiated Section 106 Consultation with the Florida SHPO and sent a formal Section 106 consultation letter to the SHPO on March 2, 2020 (see **Appendix A**). The letter described the proposed undertaking (i.e., Proposed Action) APE and requested SHPO concurrence on the determination of the APE. The SHPO provided concurrence with the APE on March 10, 2020. The FAA sent the Florida SHPO a finding of effect letter on March 26, 2020, stating that the proposed project would have no adverse effect on historic properties. The SHPO concurred with the FAA's determination on August 3, 2020.

### 3.3.3 Government-to-Government Consultation

In accordance with Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments*, FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, and 36



CFR § 800.2(c)(2)(B)(ii), the FAA identified Native American tribes that may have an interest in the counties within the APE:

- Catawba Indian Nation,
- Chitimacha Tribe of Louisiana,
- Coushatta Tribe of Louisiana,
- Eastern Band of Cherokee Indians,
- Jena Band of Choctaw Indians,
- Miccosukee Tribe of Indians of Florida,
- Muscogee (Creek) Nation,
- Poarch Band of Creek Indians, and
- Seminole Tribe of Florida.

These tribes were identified using the U.S. Housing and Urban Development (HUD) Tribal Directory Assessment Tool (TDAT), a web-accessible database that contains information about federally recognized Indian tribes and their geographic areas of current and ancestral interest. For this PEA, the TDAT database was queried for Florida counties that intersect the APE. The APE is the same area as the study area, and therefore encompasses portions of Brevard and Volusia counties.

The FAA initiated Section 106 and Government-to-Government consultation with tribes on March 31, 2020. The Seminole Tribe of Florida (STOF) responded on April 23, 2020, that the proposed Undertaking falls within the STOF Area of Interest, but they were not aware of any sites of religious or cultural significance located in the APE and had no objections at that time. No other tribes responded to the FAA's consultation letter as of October 2020.

### 3.3.4 Historic Resources

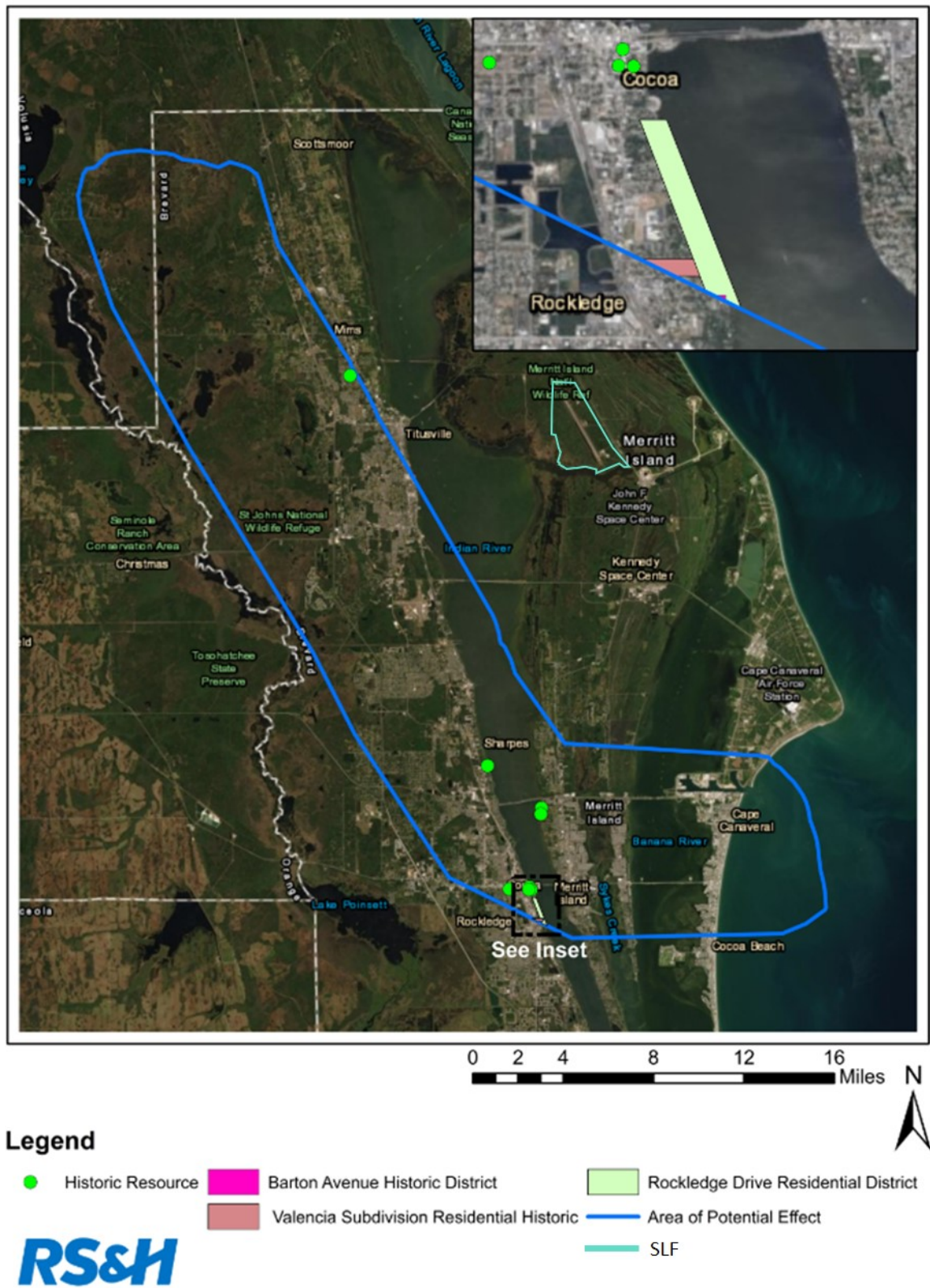
Research information on historic properties within the APE was obtained from the National Park Service (NPS) National Register of Historic Places (NRHP) and the Florida Master Site File. **Table 3-3** lists the NRHP-listed and NRHP-eligible sites in the APE. **Figure 3-5** shows the location of these sites in relation to the APE.

**TABLE 3-3: NRHP RESOURCES IN THE APE**

Resource Name	Resource Type
Aladdin Theater	Listed in NRHP
Barton Ave Residential District	Listed in NRHP
Cape Canaveral Air Force Station	Listed in NRHP
City Point Community Church	Listed in NRHP
Cocoa Junior High	Eligible for NRHP
Cocoa Post Office	Eligible for NRHP
Dr. George E Hill House	Listed in NRHP
J.R. Field, Homestead	Listed in NRHP
La Grange Church and Cemetery	Listed in NRHP
Porcher House	Listed in NRHP
Rockledge Drive Residential District	Listed in NRHP
Valencia Subdivision Residential Historic	Listed in NRHP

Sources: (NPS, National Register of Historic Places, 2019) (DHR, 2019)

FIGURE 3-5: NRHP RESOURCES IN THE APE



Source: (ESRI, 2019) (RS&H, 2019) (DHR, 2019)

### 3.4 NOISE AND NOISE-COMPATIBLE LAND USE

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. FAA Order 1050.1F, Exhibit 4-1 defines the FAA's significance threshold for noise and noise compatible land use as follows. "The action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dB to 65 dB."

When a vehicle moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the vehicle is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. Sonic booms are classified as transient noise events and sonic boom levels are described in units of peak overpressure in pounds per square foot (psf). Sonic boom peak overpressures are used to assess single event noise impacts (BRRC, 2019).

Sonic booms are evaluated on a single-event basis in relation to hearing conservation and structural damage criteria. Although FAA Order 1050.1F does not have guidance on hearing conservation or structural damage criteria, it recognizes the use of supplemental noise analysis to describe the noise impact resulting from sonic booms and assist in the public's understanding of the potential noise impact. For example, the National Institute for Occupational Safety and Health (OSHA, 2017) and Occupational Safety and Health Administration (OSHA, 2017) state that levels should not exceed 140 dB peak sound pressure level, which equates to a sonic boom level of approximately 4 psf.

Sonic booms can also be associated with structural damage. A large degree of variability exists in damage experience, and much of the damage depends on the pre-existing condition of a structure. For example, most damage claims are for brittle objects, such as glass and plaster. The probability of a window breaking at 1 psf ranges from one in a billion (Sutherland, 1990) to one in a million (Higgins, 1976). Damage to plaster occurs at similar ranges to glass damage. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf (Nakaki, 1989) below which damage is unlikely.

According to the Final Programmatic EIS for Commercial Reentry Vehicles, thunder overpressure resulting from lightning strikes at a distance of 0.6 mile (1 kilometer) is almost indistinguishable from that of a sonic boom (FAA, 1992). According to the National Weather Service lightning statistics, Brevard County experiences approximately 22,000 lightning strikes a year (National Weather Service, 2018). When accounting for the population density of Brevard County and the affected area of the thunder overpressure of a lightning strike within 0.6 mile, it is estimated that each resident in Brevard County experiences more than 20 events a year with an overpressure greater than 2.09 psf (FAA, Office of Commercial Space Transportation, 1992). The average resident in Brevard County is exposed to thunder overpressure events caused by lightning on a regular basis in excess of the psf levels used to establish the extent of the study area.

The current noise environment in the study area includes vertically launched rockets that take off from launch complexes at Cape Canaveral Spaceport. Some vertically launched rockets have stages which return to land. These returning stages result in sonic booms that are heard by residents within the study area. Other existing sources of noise within the study area include aircraft operations, orbital test vehicles, construction vehicles and equipment, surface transportation vehicles (e.g., personal cars), urban/residential noise, and natural noise (e.g., nature).

Further details and information related to sonic booms is provided in *Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis* in **Appendix B** of this PEA.

### 3.5 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, CHILDREN'S HEALTH AND SAFETY RISKS

This section describes the existing demographics of the study area as they relate to socioeconomic, environmental justice, and children's environmental health and safety risks.

Due to Brevard County's greater concentration of population, the majority of workers associated with the Proposed Action are likely to reside in Brevard County. U.S. Census Bureau information for Brevard County is the basis of the socioeconomic and environmental justice analyses. The analysis of children's environmental health and safety is limited to the study area.

#### 3.5.1 Socioeconomics

Population, housing, labor force, and surface transportation data for Brevard County is included as the basis for evaluating potential socioeconomic impacts in **Chapter 4** of this PEA.

Population – **Table 3-4** lists the population growth from 2010 to 2018 in Brevard County. Data for the State of Florida and U.S. is included for comparison purposes. Between 2010 and 2018, the Brevard County population increased 9.8 percent. Comparatively, the population in Florida increased 13.3 percent and the population in the U.S. increased 6.0 percent.

**TABLE 3-4: POPULATION CHANGE BETWEEN 2010 AND 2018**

Area	2010	2018	Percent Change
Brevard County	543,376	596,849	9.8%
Florida	18,801,310	21,299,325	13.3%
United States	308,745,538	327,167,434	6.0%

Source: (U.S. Census Bureau, 2019).

Housing – **Table 3-5** lists the total and vacant housing units in Brevard County. Information from the State of Florida and the U.S. is included for comparison purposes. About 17 percent of the housing units in Brevard County are vacant. Comparatively, there are about 19 percent and 12 percent vacant housing units in Florida and the U.S., respectively.

**Labor Force**— According to the U.S. Census Bureau, there are 239,195 employed civilians 16 years of age and older in Brevard County, and the unemployment rate is approximately 3.1 percent. Comparatively, Florida and the U.S. have an unemployment rate of approximately 3.1 percent and 3.7 percent, respectively (U.S. Census Bureau, 2019).

**TABLE 3-5: HOUSING UNITS**

Area	Total Units	Vacant Units (Percentage)
Brevard County	271,005	17.3%
Florida	9,051,851	18.9%
United States	132,741,033	12.2%

Note: the U.S. Census Bureau considers vacant housing units those for rent; rented but not occupied; for sale; sold but not occupied; for seasonal, recreational, or occasional use; for migrant workers; and other vacant units.

Source: (Census, 2019).

**Surface Transportation** – There are several major roadways that intersect the study area. Major roadways in Brevard County include Interstate 95, State Road 528, and U.S. Highway 1. NASA Parkway provides access to CCAFS to the east and Titusville via the Indian River Bridge to the west. Secondary and access roads to specific facilities are designed to accommodate the anticipated type of traffic and payloads that reach each facility. NASA Parkway is the primary entrance and exit for cargo, tourists, and personnel to KSC. Currently, the south (main) gate on SR 401, serves as the primary entrance and exit to CCAFS for cargo and NASA personnel. (NASA, 2019)

Transport of rocket components and payloads at KSC, which includes the SLF, is a common occurrence.

**First Responders** – NASA KSC provides emergency fire and rescue services at the SLF. This protection includes fire and ambulance services staffed by paramedics and firefighters. An airport rescue firefighting facility was completed in 2007 at the south-field site of the SLF. Fire Station No. 2 is a 20,000-square-foot fire station with drive-thru bays for emergency vehicles, sleeping quarters for emergency personnel, and dining facilities. The USFWS are the first responders to events or activities within the Merritt Island NWR and St. Johns NWR, including law enforcement and fire management responses. Additional health care services are available at nearby public hospitals in Titusville, Rockledge, and Cocoa Beach. Law enforcement in the study area is provided by Brevard and Volusia County sheriff departments and local police departments.

### 3.5.2 Environmental Justice

FAA Order 1050.1F, which is consistent with USDOT Order 5610 on Environmental Justice, establishes the guidance for assessing environmental justice impacts. **Table 3-6** describes the persons in poverty within Brevard County, as well as the State of Florida and the U.S. Brevard County's percentage of persons in poverty is lower than the State of Florida, but slightly higher than the U.S.



According to the U.S. Census Bureau and shown in **Table 3-7**, about 26 percent of the population in Brevard County and about 29 percent of the population in Volusia County are minorities. Comparatively, a greater percentage of the Florida and U.S. population are minorities.

**TABLE 3-6: POVERTY LEVEL**

Area	Percentage
Brevard County	12.4%
Volusia County	15.2%
Florida	13.6%
United States	11.8%

Source: (Census, 2019).

**TABLE 3-7: MINORITY POPULATION**

Area	Percentage
Brevard County	25.9%
Volusia County	28.8%
Florida	46.5%
United States	39.4%

Source: (Census, 2019).

### 3.5.3 Children's Environmental Health and Safety Risks

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885) is the primary Executive Order related to Children's Environmental Health and Safety Risks. Executive Order 13045 directs federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children. As **Table 3-8** shows, Brevard County has a greater percentage of children than Volusia County, but less than Florida and U.S.

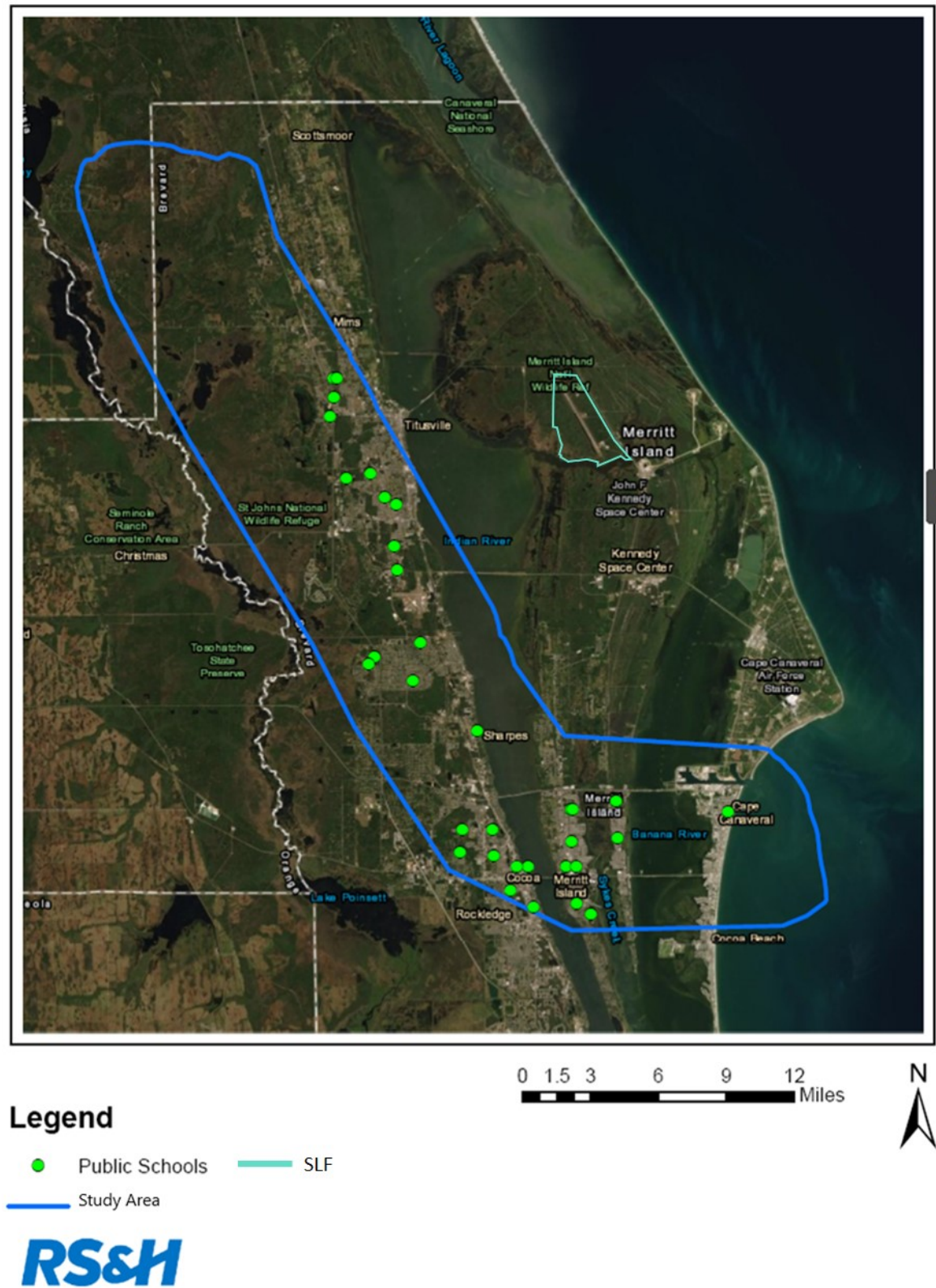
**TABLE 3-8: PERCENT OF CHILDREN UNDER 18**

Area	Percentage
Brevard County	18.2%
Volusia County	17.7%
Florida	19.9%
United States	22.4%

Source: (Census, 2019).

The study area includes the public schools within the Brevard County School system. As shown in **Figure 3-6**, there are 33 public schools located within the study area. There are no Volusia County schools within the study area.

FIGURE 3-6: PUBLIC SCHOOLS IN THE STUDY AREA



Source: (ESRI, 2019) (RS&H, 2019) (ESRI, 2019a)

CHAPTER 4

## *ENVIRONMENTAL CONSEQUENCES*



This chapter presents an analysis of the potential environmental impacts from implementation of the Proposed Action compared to the No Action Alternative. The analyses in this chapter are consistent with the policy and procedures provided in FAA Orders 1050.1F and the guidance provided in the FAA Order 1050.1F Desk Reference. The significance thresholds identified in this chapter are those presented in FAA Order 1050.1F, Exhibit 4-1. This chapter also describes potential cumulative effects.

In accordance with CEQ Regulations, this PEA integrates the requirements of NEPA and other planning and environmental review procedures required by applicable law or agency practice. This integration allows the appropriate review procedures to run concurrently rather than consecutively (40 CFR § 1500.2(c)). This chapter includes the environmental analyses associated with applicable federal statutes, executive orders, and regulations.

As **Chapter 2** describes, reentry vehicle operations would begin as early as 2021 and continue operating through 2025. This PEA evaluates the study years 2021 and 2025 to compare the potential environmental effects of the Proposed Action compared to the No Action Alternative. The reentry vehicle design parameters and forecast number of operations described in **Chapter 2 (Table 2-1 and Table 2-2)** are used for assessing the potential effects of reentry vehicle operations at the SLF.

The Proposed Action would result in up to one reentry vehicle operation at the SLF in 2021, and up to six operations in 2025. A sonic boom would occur during each flight of the reentry vehicle over the State of Florida. As the primary driver of potential environmental impacts from the Proposed Action, the analyses in this chapter evaluate the effects of these sonic boom events on the following environmental impact categories:

- **Section 4.1** - Biological Resources (including Fish, Wildlife, and Plants)
- **Section 4.2** - Department of Transportation Act, Section 4(f)
- **Section 4.3** - Historic, Architectural, Archeological, and Cultural Resources
- **Section 4.4** - Noise and Noise-Compatible Land Use
- **Section 4.5** - Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks.

The study area shown in **Figure 3-1** is the area in which the sonic boom produced by reentry activities would be 1.0 psf or greater and includes portions of two Florida counties, Brevard and Volusia. The sonic boom analysis produced results indicating that the reentry events could result in a maximum 1.1 psf sonic boom (see **Appendix B** for further details).

The FAA would not alter the dimensions (shape and altitude) of the airspace structure to accommodate the Proposed Action. Temporary closures of airspace may be necessary to ensure public safety during the proposed operations; this would be addressed in tiered environment reviews to this PEA when the FAA considers a reentry license application from a potential reentry vehicle operator. Per the procedures defined in their letter of agreement (LOA), reentry vehicle operators would notify Air Traffic Control (ATC) and schedule their operations in advance to minimize interruption of airspace operations, and Notices to Airmen (NOTAMs) would be issued to inform other airspace users of upcoming closures (see **Appendix D** for further details).

## 4.1 BIOLOGICAL RESOURCES

FAA Order 1050.1F, Exhibit 4-1, defines the FAA's significance threshold for biological resources, which states, "The U.S. Fish and Wildlife Service or the National Marine Fisheries Service determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat." In addition to the threshold above, FAA Order 1050.1F, Exhibit 4-1, provides factors to consider in evaluating the context and intensity of potential environmental impacts on biological resources. These factors are not intended to be thresholds. If these factors exist, there is not necessarily a significant impact; rather, the FAA must evaluate these factors in light of context and intensity to determine if there are significant impacts. Factors to consider that may be applicable to biological resources include, but are not limited to, situations in which the Proposed Action would have the potential for:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);
- Adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum populations levels required for population maintenance.

### 4.1.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a RSOL. Spaceport-related operations would continue under the current license (LSO 18-018). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. The No Action Alternative would not differ from existing conditions with respect to biological resources.

### 4.1.2 Proposed Action

This section describes the Proposed Action's potential effect on federally and state-listed species, migratory birds, and measures to reduce wildlife strikes. Potential impacts on common fish and wildlife within the study area are not anticipated to differ from those identified in the 2018 EA.

#### 4.1.2.1 Federally and State-listed Species

As **Chapter 3** describes, the Proposed Action would not result in ground disturbing activities at the SLF that could result in direct impacts to federally or state-listed threatened or endangered species. Operational impacts associated with the Proposed Action could potentially cause noise impacts to federally or state-listed species in the study area. The modeling results indicate that a reentry vehicle could produce a maximum 1.1 psf sonic boom over the State of Florida, which would have a similar

overpressure as natural environmental sources such as thunder. The area that has the potential to be exposed to the 1.0 psf sonic boom is the study area.

According to the Final Programmatic EIS for Commercial Reentry Vehicles, "Thunder overpressure resulting from lightning strikes at a distance of 1 km (0.6 mile) is estimated to be near 100 N/m<sup>2</sup>, [2.09 psf] and is almost indistinguishable from that of a sonic boom" (FAA, 1992). According to the National Weather Service (NWS), Brevard County can experience more than 22,000 lightning strikes a year (NWS, 2019). Wildlife are exposed to overpressure events greater than the 1.0 psf level within the study area on a regular basis. Literature suggests that many animal species do not experience lasting adverse effects to sonic booms with low overpressures (1.0 psf or less) (FAA, 2014) (Manci, 1988).

In the event a marine mammal (e.g., West Indian Manatee) or sea turtle was present in the study area during a reentry, and the area was exposed to a sonic boom, the boom would not affect the mammal. The sonic boom footprint is low intensity (similar to thunder). The sound pressure produced by the sonic boom during reentry would not affect submerged marine mammals or sea turtles because there is very little sound transmitted between the air-water interface.

As described in the FAA's March 2, 2020 letter to the USFWS, based on the lack of observed adverse effects to wildlife in scientific studies and the lack of known adverse effects to ESA-listed species over decades of launch operations at Cape Canaveral Spaceport, the FAA anticipates reentry operations (sonic booms) "*may affect, but would not adversely affect*" ESA-listed wildlife species in the study area (see **Appendix A**). USFWS concurred with the FAA's Section 7 effect determination on May 8, 2020.

#### 4.1.2.2 Migratory Birds

There is the potential for migratory birds, including bald eagles, to use the habitat in the vicinity of the SLF. In terms of potential bird strikes, the 2007 SLF EA described the average collision rate of an aircraft with a bird species is 0.08 percent (NASA, 2007). The 2018 SLF EA described operations of launch vehicles would represent about a 3.78 percent increase in aircraft activity at the SLF and would not significantly increase the chance of a bird strike during takeoff and landing activities. Operation of the reentry vehicles at the SLF would increase vehicle activity (up to one reentry operation in 2021 and up to six reentry operations in 2025 but would not significantly increase the chance of a bird strike during landing activities.

Also, as described above, the reentry vehicle would produce sonic booms over the State of Florida. These events would generate similar overpressure to natural environmental sources, such as thunder. As noted above, thunder is a very frequent occurrence in the study area. For these reasons, the Proposed Action would not significantly affect migratory birds.

#### 4.1.2.3 Existing Measures Reducing Wildlife Strikes

The SLF has a Wildlife Hazard Management Plan in place to reduce the risk of bird strikes. Management measures include inspecting runways for birds/wildlife, managing habitat near launch areas to discourage use by wildlife, use of air cannons and other scare tactics along runways, and a communications protocol

to alert vehicles of collision danger (NASA, 2012). These measures reduce the risk of impacts to birds and wildlife, as well as improving the safety of reentry vehicles landing at the SLF.

## 4.2 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F)

Resources protected by Section 4(f) consist of publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance; and publicly or privately-owned land from a historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.

FAA Order 1050.1F, Exhibit 4-1 provides the FAA's significance threshold for Section 4(f), which states, "The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a 'constructive use' based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource."

The study area was reviewed for any Section 4(f) properties. For Section 4(f) purposes, a Proposed Action constitutes a "use" of a property in one of two ways:

1. Physical use: The action physically occupies and directly uses the Section 4(f) property. An Action's occupancy or direct control (via purchase) causes a change in the use of the Section 4(f) property.
2. Constructive use: The Action indirectly uses a Section 4(f) resource by substantially impairing the resource's intended use, feature, or attributes.

This assessment uses the information consistent with the requirements of FAA Order 1050.1F, Exhibit 4-1 and **Appendix C**. The potential for constructive use of the Section 4(f) resources identified in **Section 3.3** is described below.

### 4.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. The No Action Alternative would not differ from existing conditions with respect to Section 4(f) resources.

### 4.2.2 Proposed Action

As **Chapter 3** describes, the Proposed Action would not result in ground disturbing activities at the SLF that could cause direct impacts to Section 4(f) resources. **Section 3.2** identifies over 50 parks, conservation areas, wildlife management areas, and sanctuaries in the study area. **Figure 3-4** shows the location of the national wildlife refuges in the study area. Operations of reentry vehicles would not require the use of any Section 4(f) properties and, therefore, would not require the physical use (direct impact) of Section 4(f) properties.

The Proposed Action would result in one sonic boom in 2021 and up to six sonic booms in 2025. The maximum sonic boom overpressure estimated to occur within the study area would be 1.1 psf. The intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. It is estimated that, on average, each resident in the study area experiences the overpressure from a lightning strike greater than 2.09 psf more than 20 times a year. Users of the parks, conservation areas, wildlife management areas and sanctuaries located within the study area likely experience similar levels of lightning activity.

Additionally, the Proposed Action would not have other effects that would substantially impair Section 4(f) resources. For these reasons, the Proposed Action would not cause a constructive use (indirect impact) of Section 4(f) resources.

### 4.3 HISTORIC, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

FAA Order 1050.1F does not define a significance threshold for historical, architectural, archaeological, and cultural resources; however, it does provide a factor to consider in evaluating the context and intensity of potential environmental impacts. This would occur when the action would cause a finding of Adverse Effect through the Section 106 process. An adverse effect finding does not automatically trigger preparation of an EIS (i.e., a significant impact).

Potential impacts to historic resources were assessed by determining any potential indirect impacts from noise and vibration that could potentially:

- Alter the visual, audible, or atmospheric characters of the property, if the setting contributes to the property's qualification for the NRHP.
- Cause neglect of the property resulting in the property's deterioration or destruction.

Overpressure caused by sonic booms has been associated with the potential for structural damage, specifically for brittle materials such as glass and plaster. The probability of a window breaking when exposed to a sonic boom with a 1.0 psf overpressure ranges from one in a billion to one in a million, depending on the condition of the glass, while the threshold for damage from overpressure on well-maintained structures is greater than 2 psf (BRRRC, 2019). The results of the sonic boom analysis indicate that the maximum overpressure associated with operation of the Proposed Action would be 1.1 psf (see **Appendix B** for further details).

As described in **Section 3.3**, the FAA determined an APE in consideration of potential effects to historic properties from implementation of the Proposed Action. The APE is the same as the study area and encompasses the area where a sonic boom overpressure of 1 psf could occur. The SHPO issued concurrence with the APE on March 11, 2020.

#### 4.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would

be subject to review under NEPA and is not assumed under this alternative. The No Action Alternative would not affect historic, architectural, archeological, or cultural resources within the APE.

#### 4.3.2 Proposed Action

The FAA has established the APE for the Proposed Action in consideration of potential effects to historic properties. No ground disturbing activities will occur in the APE. Noise modeling was conducted as part of the project to establish the APE.

Indirect effects to cultural resources refer to potential effects to the property's use, physical features, or the area in a manner that may change the integrity of the property's significant historic features. Examples of indirect effects include introducing an atmospheric or visual feature or changing the noise characteristics of the area. Operation of reentry vehicles would increase flight activity at the SLF. As described previously, the Proposed Action would not result air quality or visual (light or viewshed) impacts.

Information on historic properties within the APE was obtained from the NRHP and the Florida Master Site File. An assessment of the Proposed Action's potential direct and indirect effects is described below.

##### 4.3.2.1 Direct Effects

The Proposed Action would not result in any direct effects on historic properties.

##### 4.3.2.2 Indirect Effects

The potential effects for architectural resources include the introduction of short-term auditory effects on noise-sensitive historic properties during operations, and vibration caused by operation of the Proposed Action. Twelve historic resources located within the APE would potentially be affected (see **Table 3-3**).

The potential for sonic boom impacts is evaluated on a single-event and cumulative basis in relation to human annoyance, hearing conservation and structural damage criteria. The modeled maximum peak overpressure is approximately 1.1 psf. A modeled maximum of 1.1 psf translates to an equivalent CDNL<sup>7</sup> of 41.2 dBC. Noise caused by the proposed reentry vehicle operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA).<sup>8</sup> The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf criterion described above.

##### 4.3.2.3 FAA's Finding of Effect

The descent of the reentry vehicle would generate a sonic boom. The Proposed Action would result in one sonic boom in 2021 and up to six sonic booms in 2025. The maximum sonic boom overpressure estimated to occur within the study area would be 1.1 psf. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf. In terms of auditory effects, the intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in

<sup>7</sup> CDNL is the C-weighted Day-Night Level (DNL). C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.

<sup>8</sup> Areas exposed to DNL 65 dBA or lower are compatible with all land uses.

intensity. It is estimated that, on average, each resident in the study area experiences the overpressure from a lightning strike greater than 2.09 psf more than 20 times a year (FAA, Office of Commercial Space Transportation, 1992). Users of the historic properties located within the study area likely experience similar levels of lightning activity.

Therefore, noise effects associated with the reentry vehicle would not have an adverse effect on historic properties in the APE. Based on the results of the studies and an assessment of effects to historic properties, the FAA has determined that this undertaking will have No Adverse Effect on historic properties.

The FAA sent a formal Section 106 consultation letter to the SHPO on March 26, 2020 describing the FAA's determination that the proposed undertaking would have "No Adverse Effect" to historic properties. The SHPO provided concurrence with the FAA's no adverse effect to historic properties determination on August 3, 2020 (see **Appendix A**).

#### 4.4 NOISE AND NOISE-COMPATIBLE LAND USE

Research shows that the loudness of individual events, the number of events during a given period, and the time of day in which noise events occur influences the sensitivity to noise. The Day-Night Average Sound Level (DNL) accounts for these factors by accumulating the sound energy generated by all noise events during the course of a given period (an annual average day) with a 10 dB penalty to sound levels occurring between 10:00 p.m. and 6:59 a.m. This 10 dB penalty means that one nighttime sound event is equivalent to 10 daytime events of the same level.

FAA Order 1050.1F, Exhibit 4-1 defines the FAA's significance threshold for noise and noise compatible land use as follows. "The action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the No Action alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dB to 65 dB."

Noise analyses and evaluations of potential impacts for reentry vehicles can vary substantially from approaches used by the FAA for civil aircraft and airports for several reasons. One reason is the low-frequencies component of the spectral characteristic of the reentry vehicle noise. Such low frequency noise can propagate for much longer distances than that of jet or propeller aircraft noise and can be perceived as a "rumbling" noise. Also, reentry vehicles create sonic booms when they operate above the speed of sound. As a result, noise modeling and assessment for reentry vehicles differs from modeling and assessment of civil aircraft and airports. Nevertheless, the basic elements of FAA noise assessment for NEPA, including the proximity of noise sensitive receptors and the DNL 65 dB significance threshold, are applicable. Since sonic boom measurements results are typically presented in terms of psf, a conversion is needed to obtain CDNL<sup>9</sup> values. This allows for a comparison to FAA's significance threshold in DNL. The

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<sup>9</sup> CDNL is the C-weighted DNL. C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.



psf metric is used to determine potential structural damage to buildings, while CDNL is applied during the assessment of potential human annoyance.

#### 4.4.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative.

#### 4.4.2 Proposed Action

The FAA-approved sonic boom model, PCBOOM, was used to analyze the potential noise of the supersonic landing of the proposed reentry vehicle at the SLF. Noise exposure less than the significance threshold of CDNL 60 dBC for impulsive noise sources, is equivalent to the DNL 65 dBA threshold for significant aviation noise impacts. Four daytime reentries and two nighttime reentries (six reentries total annually) would result in a modeled maximum of 1.1 psf, which is equivalent to CDNL 41.2 dBC. The Proposed Action's noise exposure would be less than the significance threshold of DNL 65 dBA (equivalent to CDNL 60 dBC).

The potential for hearing damage is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criterion described previously. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

Although the Proposed Action would not cause significant impacts in relation to human annoyance, hearing conservations, or structural damage; the unexpected, loud impulsive noise of sonic booms may cause a startle effect in people. When humans are exposed to impulse noises with similar characteristics on a regular basis, they tend to become conditioned to the stimulus and the resulting startle reaction is generally not displayed. The physiological effects of single sonic booms on humans (FAA, 1992) for the levels produced by a reentry vehicle are presented in **Table 4-1**.

The Proposed Action's modeled maximum peak overpressure is approximately 1.1 psf, which would have the potential to result in a mixed pattern of startled response behavioral effects. See **Appendix B** for further information.

**TABLE 4-1: PHYSIOLOGICAL EFFECTS OF SINGLE SONIC BOOMS ON HUMANS**

Sonic Boom Overpressure	Behavioral Effects
0.3 psf	Orienting, but no startle response; eyeblink response in 10% of subjects; no arm/hand movement.
0.6 - 2.3 psf	Mixed pattern of orienting and startle responses; eyeblink in about half of subjects; arm/hand movements in about a fourth of subjects, but not gross bodily movements

Source: (FAA, 1992)



## 4.5 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

FAA Order 1050.1F does not define significance thresholds for Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks; however, it does identify the following factors to consider in evaluating the context and intensity of potential environmental impacts.

Socioeconomics considerations include the potential of the action to:

- "Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area);
- Disrupt or divide the physical arrangement of an established community;
- Cause extensive relocation when sufficient replacement housing is unavailable;
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities;
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities; or
- Produce a substantial change in the community tax base."

Environmental justice considerations include the potential of the action to lead to a disproportionately high and adverse impact to low-income and/or minority populations from:

- "Significant impacts in other environmental impact categories; or
- Impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population."

Considerations for children's environmental health and safety risks include the potential of the action to lead to a disproportionate health or safety risk to children.

U.S. Census demographic data were used to evaluate the potential effects of Proposed Action compared to the No Action Alternative.

### 4.5.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. There would be no change in socioeconomic trends or in those relating to environmental justice or children's environmental health and safety risks.

### 4.5.2 Proposed Action

The following subsections describe the potential effects of the Proposed Action on socioeconomics, environmental justice, and children's environmental health and safety risks.

#### 4.5.2.1 Socioeconomics

The following analysis describes the potential effects of the Proposed Action on population and housing, labor force, and transportation and why those effects would not be significant.

*Population and Housing* - As described in **Section 2.1**, a reentry vehicle operator may employ 10 to 40 people for post-reentry procedures. Employees could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the number and type of operations. As stated in **Chapter 3**, the majority of workers associated with the Proposed Action are likely to reside in Brevard County. Therefore, the Proposed Action would not result in an increase in population for Brevard and Volusia counties.

The Proposed Action would not require the relocation of existing residents or disrupt or divide the physical arrangement of an established community. About 18 percent of the housing units in Brevard County and Volusia counties are vacant. Therefore, there is available housing in the area should potential future employees seek housing near the SLF.

*Labor Force* - The potential increase of up to 40 employees from the Proposed Action would not significantly affect Brevard or Volusia county's labor force. The Proposed Action would not require the relocation of any businesses and, therefore, would not decrease the existing labor force or local fiscal revenue, cause extensive relocation of community businesses that would cause severe economic hardship for affected communities, or produce a substantial change in the community tax base. The nature, timing, and extent of this other development (including potential effects on labor force and local revenue) cannot be foreseen at this time and is not included in this analysis.

*Transportation* - This PEA assumes there would be an increase of up to 40 employees at the SLF from the Proposed Action. Traffic levels at Cape Canaveral Spaceport are currently low and have sufficient capacity to accommodate minor increases in traffic for new traffic (compared to the No Action Alternative) that could be associated with up to six proposed launches annually in 2025. Therefore, the Proposed Action would not significantly disrupt local traffic patterns and substantially reduce the levels of service of roads serving the SLF and its surrounding communities.

#### 4.5.2.2 Environmental Justice

As **Section 3.5** describes, there are minority and low-income populations in Brevard and Volusia counties. The Proposed Action does not include construction or the development of facilities at the SLF that would directly affect environmental justice minority and low-income populations. Similarly, operation of the Proposed Action would not result in significant impacts to any resource that would affect minority and/or low-income populations. The following section describes the analysis of environmental justice impacts. USEPA "EJSCREEN" is an environmental justice mapping and screening tool that provides a nationally consistent dataset and approach for combining environmental and demographic indicators (i.e., percent low-income; percent minority; less than high school education; linguistic isolation; individuals under age 5 and individuals over age 64) (USEPA, 2019a).

**Figure 4-1** and **Figure 4-2** show minority and low-income percentiles within the study area, respectively. **Table 4-2** shows minority and low-income comparison data of the study area, State of Florida, USEPA region, and the U.S.

**TABLE 4-2: STUDY AREA DEMOGRAPHIC INDICATORS**

Demographic Indicator	Study Area	Florida Average	EPA Region Average	U.S. Average
Minority Population	22%	44%	38%	38%
Low-Income Population	36%	37%	38%	34%
Demographic Index	29%	41%	38%	36%

Source: (USEPA, 2019)

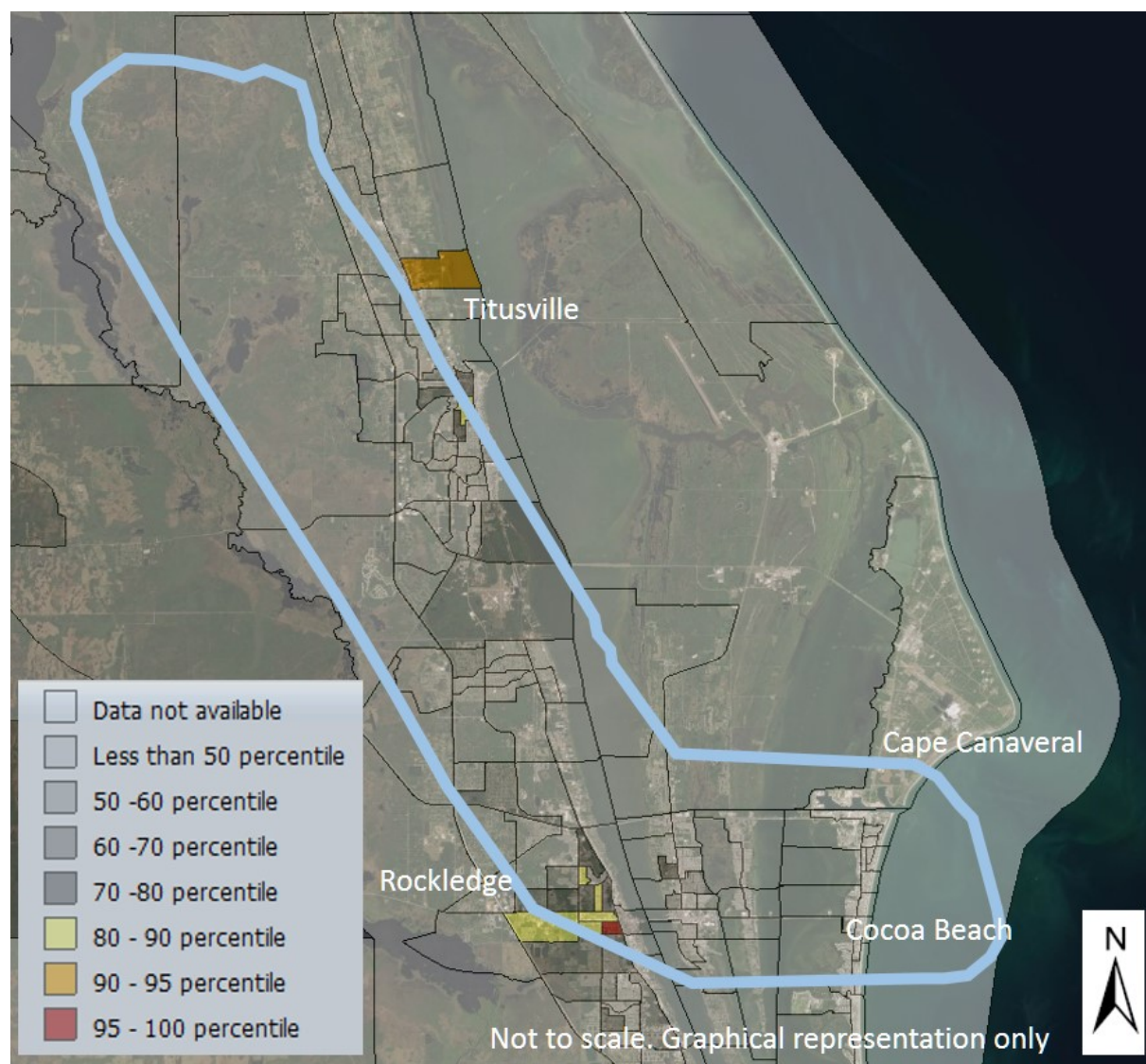
The analysis of potential environmental justice impacts also considered noise. The significance threshold for impulsive noise sources is CDNL 60 dBC (equivalent to DNL 65 dBA). As described in **Section 4.4**, a modeled maximum of 1.1 psf for six reentries (four daytime reentries and two nighttime reentries) is equivalent to CDNL 41.2 dBC. Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance. As noted previously, the potential for hearing damage is negligible because the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criterion. The potential for structural damage to a disproportional number of environmental justice communities in the study area is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

Overall, the Proposed Action would not have disproportionately high or adverse human health or environmental effects to minority or low-income populations.

#### 4.5.2.3 Children's Environmental Health and Safety Risks

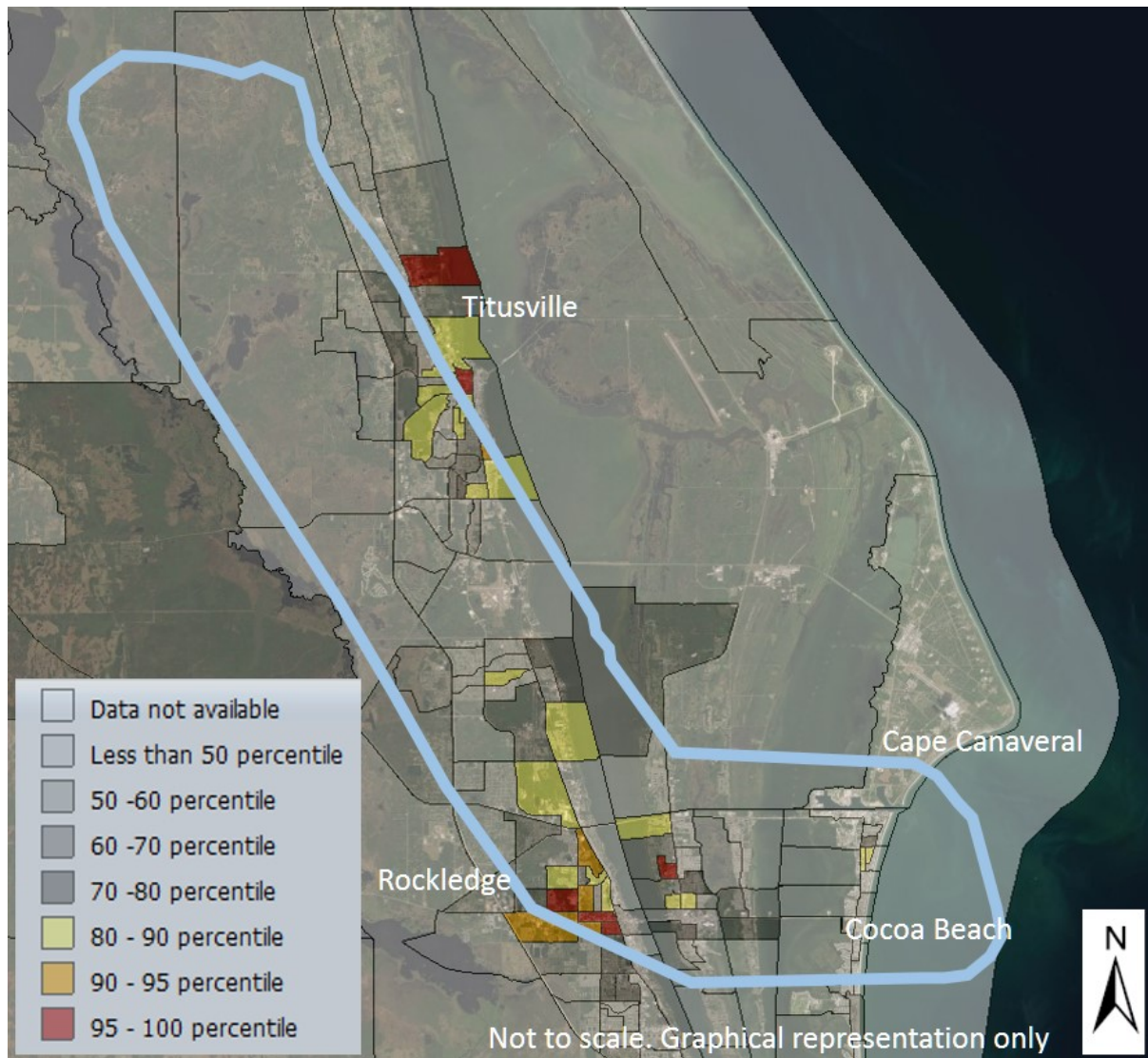
The Proposed Action does not include construction or the development of facilities at the SLF and would not directly affect surrounding communities. Access to the SLF requires security clearance or escort by approved access by unaccompanied children. As described below, operation of the Proposed Action would not affect environmental impact categories that would represent an environmental safety risk to children.

The 33 public schools within the study area would be affected by up to one sonic boom in 2021 and up to six sonic booms in 2025. Therefore, the potential for routine classroom disruption is negligible.

**FIGURE 4-1 : STUDY AREA MINORITY PERCENTILES**

Source: (USEPA, 2019)



**FIGURE 4-2: STUDY AREA LOW-INCOME PERCENTILES**

Source: (USEPA, 2019)

As described in **Section 4.4**, a modeled maximum of 1.1 psf for six annual reentries (four daytime reentries and two nighttime reentries) is equivalent to CDNL 41.2 dBC. Noise exposure from these operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure.

The potential for hearing damage is negligible because as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criteria. The potential for structural damage to any of the 33 public schools in the study area is unlikely as the modeled sonic boom overpressure levels over land are less than the 2 psf threshold for potential

structural damage. Therefore, the Proposed Action would not significantly affect children's environmental health and/or safety.

## 4.6 CUMULATIVE IMPACTS

Cumulative impacts are defined by CEQ in 40 CFR § 1508.7 as, "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Additionally, CEQ describes in *Considering Cumulative Effects under NEPA* that, "each resource, ecosystem and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." The CEQ regulations require the analysis and disclosure of the Proposed Action's potential cumulative effects (40 CFR §§ 1508.25(a)(2) and (3)). The disclosure of potential cumulative effects informs the public if the Proposed Action, when considered with other projects occurring in the past, present, or reasonably foreseeable future, would contribute to potentially significant cumulative effects.

When a prospective vehicle operator applies to operate a reentry vehicle at SLF, the applicant would prepare separate environmental document, tiering off this PEA. Cumulative environmental impacts related to vehicle operations under that reentry vehicle license would be analyzed, if appropriate.

Past, present, and reasonably foreseeable future cumulative projects were listed and analyzed in the 2018 EA. Since some future projects are in various stages of conceptual development and are speculative at this time, it is not possible to fully quantify the effects associated with them. Projects in early planning phases do not provide enough data to ensure reasonable analyses and are subject to change.

In order to contribute to a cumulative impact, the Proposed Action must first cause an impact to a specific environmental impact category. For that reason, cumulative effects are only considered for those resources that the Proposed Action would affect to some degree. Implementation of the Proposed Action would cause less than significant adverse environmental effects.

The spatial boundary for this cumulative analysis is the study area, which encompasses sufficient area to capture the extent of the Proposed Action's ability to contribute to potentially significant cumulative effects. As discussed earlier, the primary driver of potential impacts is noise. As described in **Section 4.4**, the Proposed Action's reentries would result in a modeled maximum of 1.1 psf, which is equivalent to CDNL 41.2 dBC. This noise exposure would be less than the significance threshold of DNL 65 dBA (equivalent to CDNL 60 dBC) and compatible with Section 4(f) Resources and Historic, Architectural, Archaeological, and Cultural Resources.<sup>10</sup>

The existing returning stages of vertical rockets to Cape Canaveral Spaceport have resulted in sonic booms that would intersect with the study area. Other existing sources of noise within the study area

<sup>10</sup> According to FAA Order 1050.1F Desk Reference, Exhibit 11-3, recreational land uses exposed to less than DNL 65 dBA are considered compatible.

include aircraft operations, orbital test vehicles, construction vehicles and equipment, surface transportation vehicles (e.g., personal cars), urban/residential noise, and natural noise. In the event a marine mammal (e.g., West Indian Manatee) or sea turtle was present during the descent of a reentry vehicle or returning vertical rocket stage, and the area was exposed to a sonic boom, the boom would not affect the mammal. The sonic boom footprint is low intensity (similar to thunder). The sound pressure produced by the sonic boom during reentry would not affect submerged marine mammals or sea turtles because there is very little sound transmitted between the air-water interface.

The development at Cape Canaveral Spaceport and the SLF has brought more business to the area in the past, and future development is likely to do the same. Space Florida continues to be sought by prospective operators with vehicles in various stages of conceptual development interested in utilizing the SLF. In the reasonably foreseeable future, prospective operators seeking licenses for experimental permits, high-altitude manned-balloon vehicles, and/or unmanned aerial vehicles (UAVs) could propose operations at the SLF. While these prospective operators are not anticipated to contribute to potential significant noise impacts, they could result in other environmental impacts such as a visual and socioeconomic impact to the region. For example, a prospective operator's high-altitude manned balloon operation would be visually different than a vertical rocket's rapid ascent/descent or the landing of a reentry vehicle. The Proposed Action would contribute slightly to this economic activity, which would increase the number of employees working in the area and associated need for public services. Brevard County is expected to have sufficient housing to meet the needs of new employees. Additionally, the local municipalities have sufficient public services (water, power, police, and fire services) to support this growth.

Therefore, the Proposed Action, in addition to past, present, and reasonably foreseeable future actions, is not anticipated to cause significant cumulative effects to Biological Resources, DOT Section 4(f) Resources, Historic, Architectural, Archaeological or Cultural Resources or Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety.



CHAPTER 5

*LIST OF PREPARERS*

## 5.1 LEAD AGENCY

The FAA is the lead agency for the preparation of this EA. Responsibility for review of this EA rests with the FAA. Listed below are the identities of the principal FAA individuals that participated in the preparation of this EA, in accordance with Section 1502.7 of the CEQ Regulations and FAA Order 1050.1F.

### **Stacey M. Zee**

Position: Environmental Protection Specialist, FAA Office of Commercial Space Transportation

Education: Master of Science, Environmental Policy and Management, University of North Carolina; Bachelor of Science, Natural Resources Management, Cornell University

Experience: Ms. Zee has over 20 years of environmental impact assessment experience.

## 5.2 PRINCIPAL PREPARERS

Responsibility for preparation of this EA rests with Space Florida. Listed below are the employees of Space Florida and the consulting firms responsible for the preparation of this EA. The consultant to Space Florida has experience in environmental planning. It is recognized that no one individual can be an expert in all of the environmental analysis presented in this EA. As such, an interdisciplinary team of technicians and experts in various tops was required to prepare this EA.

### **Mark Bontrager**

Position: Vice President, Spaceport Operations

Education: Bachelor of Science, University of Florida, Computer Engineering; Master of Engineering, University of Colorado, Space Operations

Experience: 22 years, U.S. Air Force; 10 years, Space Florida

### **Pete Eggert**

Position: Director, Environmental Health and Safety

Education: Bachelor of Science in Environmental Science, Stetson University

Experience: 17 years

### 5.2.1 RS&H, Inc.

#### **David Alberts**

Position: Senior Environmental Planner, Southeast Region Environmental Service Group Leader

Education: Bachelor of Arts in Geography, University of South Florida, 1997

Experience: Mr. Alberts has 20 years of NEPA related experience. He has managed and prepared federal EISs, EAs, and documented CATEXs, as well as state environmental documents for a variety of major air carrier and general aviation airports and spaceports throughout the United States.

**Richard Rogers**

Position: Project Manager, Spaceport Planning Leader

Education: Bachelor of Science in Aerospace Engineering, University of Central Florida, 2009

Experience: Mr. Rogers has nine years of experience in the aerospace and defense industry providing spaceport planning, licensing, and the mechanical design, manufacturing, systems testing, and launch services for launch vehicles. He has managed FAA spaceport licensing and EA projects for spaceports throughout the United States.

**Monica Hamblin**

Position: Environmental Planner

Education: Bachelors of Science, Interdisciplinary Studies-Environmental Science. University of Central Florida, 2017.

Experience: Ms. Hamblin has experience conducting NEPA research, analysis, and documentation for commercial and general aviation airports.

**William “Bill” Willkie**

Position: Senior Environmental Planner, Western Region Environmental Service Group Leader

Education: Master of City Planning in Environmental, Georgia Institute of Technology, 1981; Bachelor of Fine Art in Architecture, University of New Mexico, 1973

Experience: Mr. Willkie has over 30 years of aviation environmental planning experience. His professional experience includes management and/or technical leadership of NEPA studies for airport development and airspace actions, as well as noise compatibility studies under Federal Aviation Regulations Part 150 for commercial airports across the nation.

**5.2.2 Kimley Horn and Associates****Brian Gulliver**

Position: Leader, Aerospace and Spaceport Practice

Education: Master of Mechanical Engineering, University of Central Florida, 2003

Experience: Mr. Gulliver has 15 years of experience in the planning, design and licensing of federal and commercial launch facilities and spaceports.

**Elyse Mize**

Position: Senior Environmental Planner

Education: Bachelor of Science, Natural Resources, North Carolina State University, 2009

Experience: Ms. Mize has 10 years of experience supporting the environmental review process for the issuance of Launch Site Operator Licenses, Launch Operator Licenses, and Experimental Permits.

### 5.2.3 Blue Ridge Research and Consulting, LLC

**Michael M. James**

Position: Senior Vice President, Principal and Founding Member of Blue Ridge Research and Consulting, LLC

Education: Master of Science in Mechanical Engineering, Virginia Tech

Experience: Mr. James conducts applied research and consulting studies on high amplitude noise sources and their effects on communities and the environment. His research focus is developing innovative measurement, analysis, and modeling techniques to characterize and map the noise emitted from jet and rocket engines/motors. He has performed over 35 large-scale sound and vibration measurements for military and civilian aviation, weaponry, and blast noise to develop reference noise data and advanced propagation algorithms.

**Alexandria R. Salton**

Position: Senior Engineer

Education: Master of Science in Acoustics, The Pennsylvania State University

Experience: Ms. Salton is responsible for a variety of research and consulting tasks focusing on rocket noise. Current projects include developing rocket launch noise models associated with evaluating environmental noise for FAA studies. Ms. Salton's recent focus has been developing improved rocket noise source modeling techniques from full-scale measured data, enabling more accurate prediction of launch load, and environmental impacts.

CHAPTER 6

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## *APPENDIX A: AGENCY COORDINATION*



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## **APPENDIX A-1 – EARLY COORDINATION LETTERS DISTRIBUTED AND RECEIVED**

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10748 Deerwood Park Boulevard S  
Jacksonville, Florida 32256

☎ 904-256-2500  
F 904-256-2501  
[rsandh.com](http://rsandh.com)

September 13, 2019

NAME

TITLE

AGENCY

ADDRESS

CITY, STATE, ZIP

**RE: National Environmental Policy Act (NEPA) Early Agency Coordination  
Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing  
Facility, Cape Canaveral Spaceport, Florida**

Dear [Mr./Ms. LAST NAME],

The purpose of this letter is to seek input regarding potential environmental impacts that may be associated with the operation of concept reentry vehicles landing at the Shuttle Landing Facility at Cape Canaveral Spaceport (SLF) (see **Attachment 1**).<sup>1</sup>

Space Florida, an independent Special District of the State of Florida, prepared a 2018 Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The Federal Aviation Administration (FAA) accepted the 2018 EA as a Federal document and issued a Finding of No Significant Impact (FONSI) on November 2, 2018. The FAA issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Since the FONSI, Space Florida proposes to add concept reentry vehicle operations with new flightpaths to the Proposed Action. As a result, and in compliance with NEPA, a Draft Supplemental EA (SEA) has recently kicked off to disclose the changes to the Proposed Action and the potential environmental effects.

Under the Proposed Action, the FAA would issue a Reentry Site Operator License (RSOL) to Space Florida for the operation of a commercial space reentry site at the SLF. The FAA would amend Space Florida's current LSOL for the site to include the RSOL. Commercial space operators may also use the SEA to support their application to acquire a reentry license to allow them to conduct horizontal landings of concept reentry vehicles at the SLF should their operations match those described and assessed within the SEA. However, should a prospective vehicle operator's reentry footprint fall outside that analyzed in the SEA, the FAA would re-evaluate the potential impacts and, if necessary, prepare additional NEPA documentation.

The Proposed Action is subject to environmental review under NEPA. The FAA is the lead Federal agency and is preparing a SEA in accordance with NEPA, Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The purpose of a NEPA analysis is to ensure full disclosure and consideration of environmental information in federal agency decision-making.

---

<sup>1</sup> Cape Canaveral Spaceport is defined in Florida Statute 331.304

Due to jurisdiction and special expertise related to the Proposed Action, NASA, the U.S. Air Force, U.S. Fish and Wildlife Service, and National Park Service are again cooperating agencies in the development of the SEA.

Under the Proposed Action to be addressed in the SEA, the FAA would modify Space Florida's LSOL (LSO 18-018) for the landing of a concept reentry vehicle at the SLF. The FAA may use the SEA to support the issuance of licenses to prospective operators (when their operations match those described and assessed within the SEA) that would allow them to conduct concept reentry vehicle landings at the SLF.

### **Concept Reentry Vehicle**

The concept reentry vehicle parameters considered in the SEA are summarized in the **Table 1**. The purpose of describing these parameters is to broadly assess the potential impacts of concept reentry vehicle operations at the SLF. This information does not necessarily reflect the exact concept reentry vehicle(s) that would operate at the SLF. However, if a prospective operator's concept reentry vehicle parameters fall outside the parameters analyzed in the SEA, or otherwise involve new circumstances or information relevant to environmental concerns, the FAA would re-evaluate the potential impacts and, if necessary, prepare additional NEPA analysis (FAA Order 1050.1F, Paragraph 9-3).

The concept reentry vehicle parameters considered in the SEA is similar to, but not limited to, the Sierra Nevada Corporation (SNC) *Dream Chaser*® spacecraft. **Attachment 2** depicts a concept reentry vehicle.

**Table 1: Concept Reentry Vehicle Parameters**

Characteristic	Data
Vehicle Length	30 ft
Wingspan	27 ft
Gross Vehicle Weight	24,600 lbs
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 ft
Cross-Range Capability	± 700 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Pressurized/Unpressurized Cargo Capacity	5,500 kg, 30 ft <sup>3</sup>
Return Payload Capacity	1,850 kg

Source: SNC, 2019

Concept reentry vehicle operators would conduct up to 6 reentries annually to the SLF over the next five years (see **Table 2**).

**Table 2: Estimated Annual Number of Reentries**

	2021	2022	2023	2024	2025
Concept Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

The concept reentry vehicle would reenter from west/southwest on an ascending trajectory before landing at the SLF. Ascending trajectories include high atmospheric overflight of Central American countries as well as varying overflight of the southern half of Florida, south of 29° North latitude. The operation of concept reentry vehicles to the SLF would not require any closures of non-involved KSC property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Orbital reentries would reenter the National Airspace System (NAS) at 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing (for approximately 25 – 40 seconds) and would enter restricted airspace approximately 25-30 miles (for approximately 2.5 - 3 minutes) prior to landing at the SLF. The concept reentry vehicle's trajectories in the NAS for landings on Runway 15 and Runway 33 are shown in **Attachment 3**.

The region of influence for the SEA is shown in **Attachment 4**.

In accordance with NEPA and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, the SEA will analyze the potential environmental effects of the Proposed Action and the No Action Alternative.

On behalf of Space Florida, we are sending you this early notification letter to:

- Advise your agency of the preparation of the SEA;
- Request any relevant information that your agency may have regarding the project site or environs; and
- Solicit early comments regarding potential environmental, social, and economic issues for consideration during the preparation of the SEA.

You may send any information and comments to Mr. Pete Eggert at [peggert@spaceflorida.gov](mailto:peggert@spaceflorida.gov) or to myself at the address provided at the top of this letter. We would appreciate your prompt response within 30 days.

On behalf of Space Florida, we would like to thank you for your interest in this project and we look forward to working with you as we prepare the SEA. If you have any questions or need additional information regarding the Proposed Action or SEA, please do not hesitate to contact Pete Eggert at (321) 730-5301 x123 or myself at (904) 256-2469.

Sincerely,



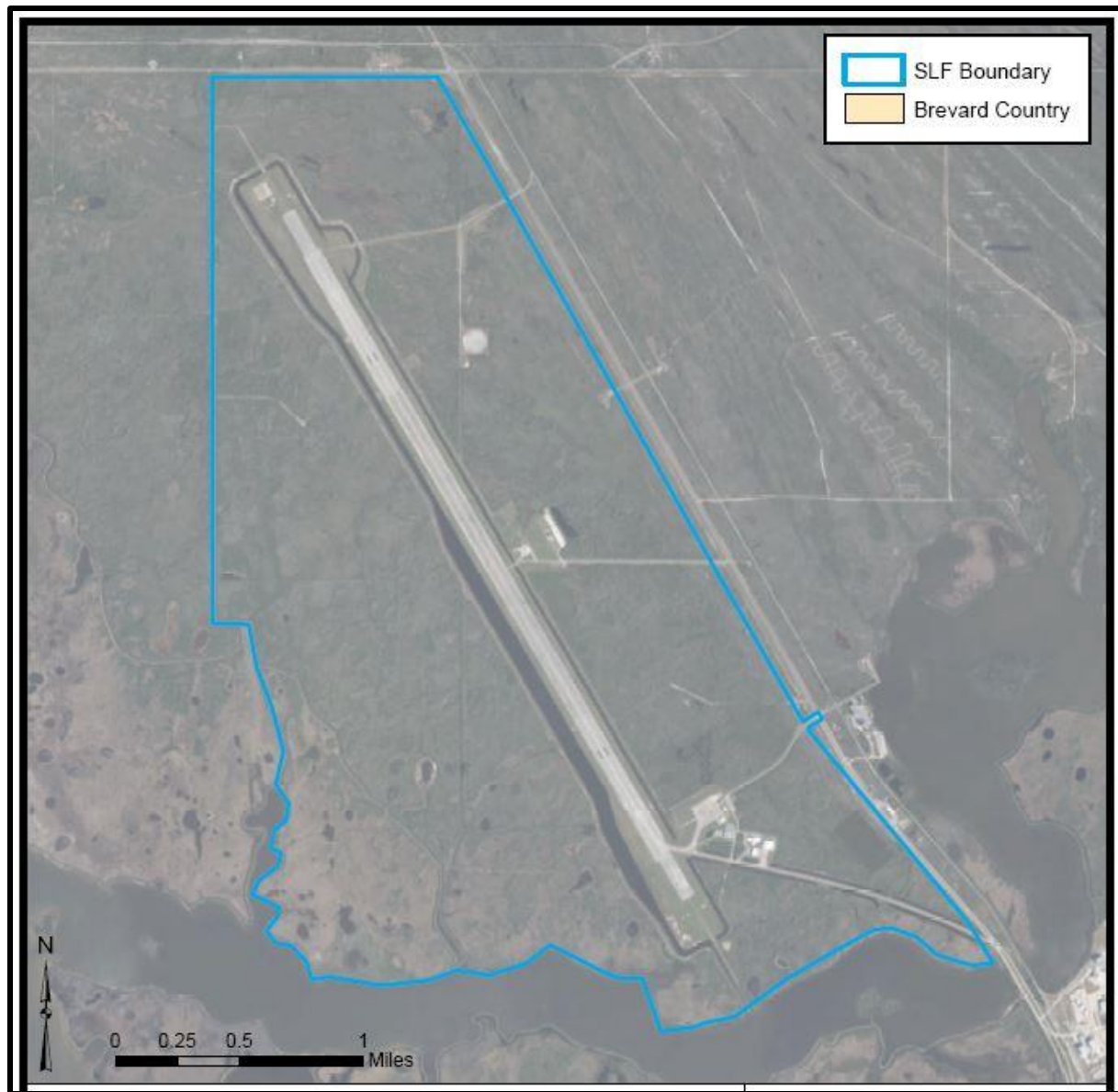
David Alberts  
Project Manager  
RS&H, Inc.

#### Attachments

cc: Pete Eggert, Space Florida  
Stacey Zee, FAA  
Rick Rogers, RS&H  
Brian Gulliver, Kimley Horn  
Project File

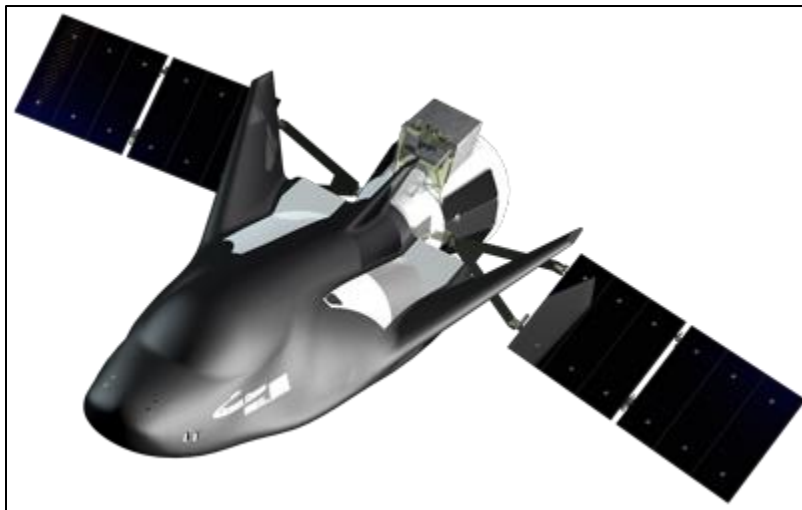


**Attachment 1: Vicinity Map**



Source: Space Florida, 2019, ESRI, 2019.

## Attachment 2: Concept Reentry Vehicle Operation

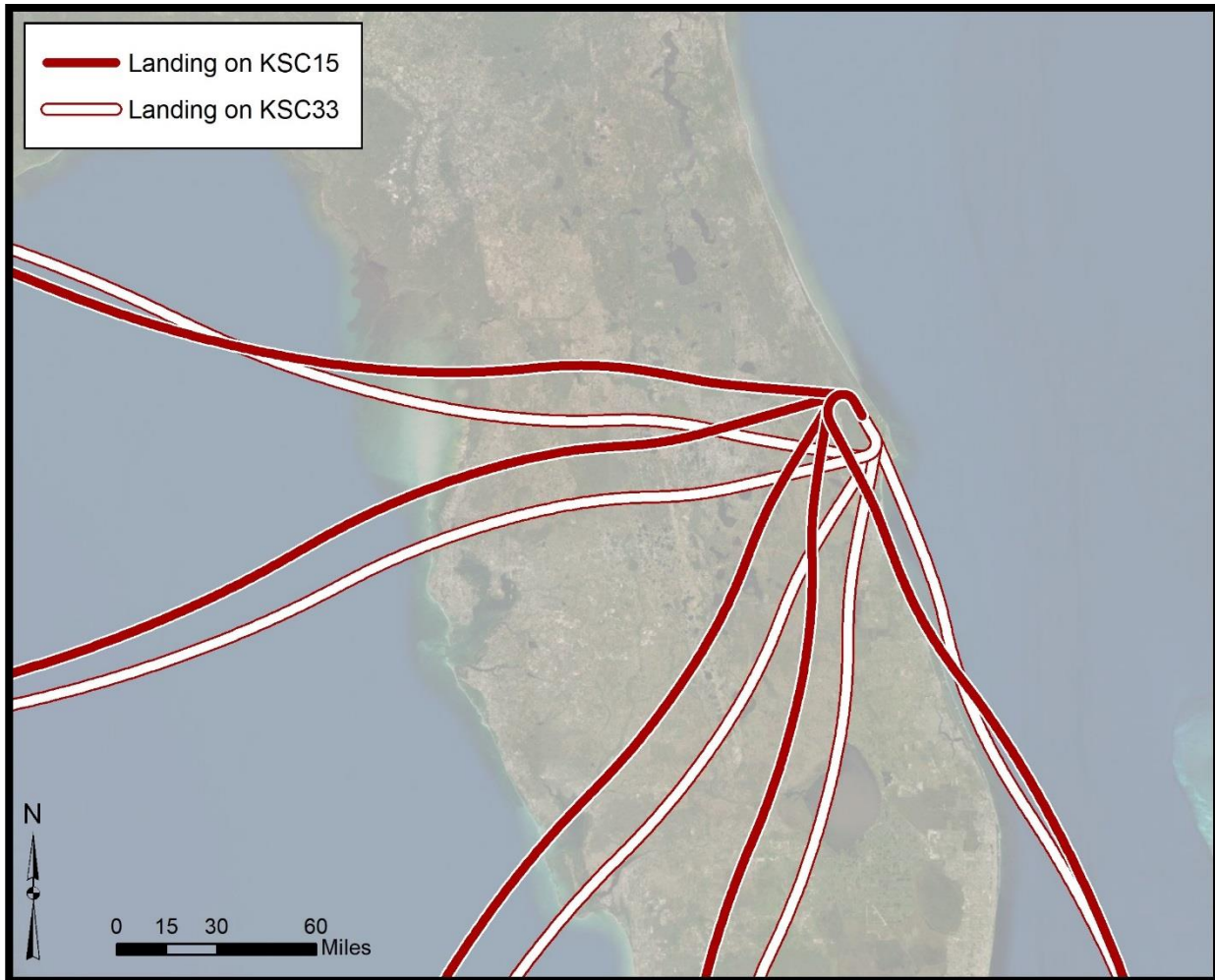


Source: SNC, 2019.



Source: SNC, 2019.

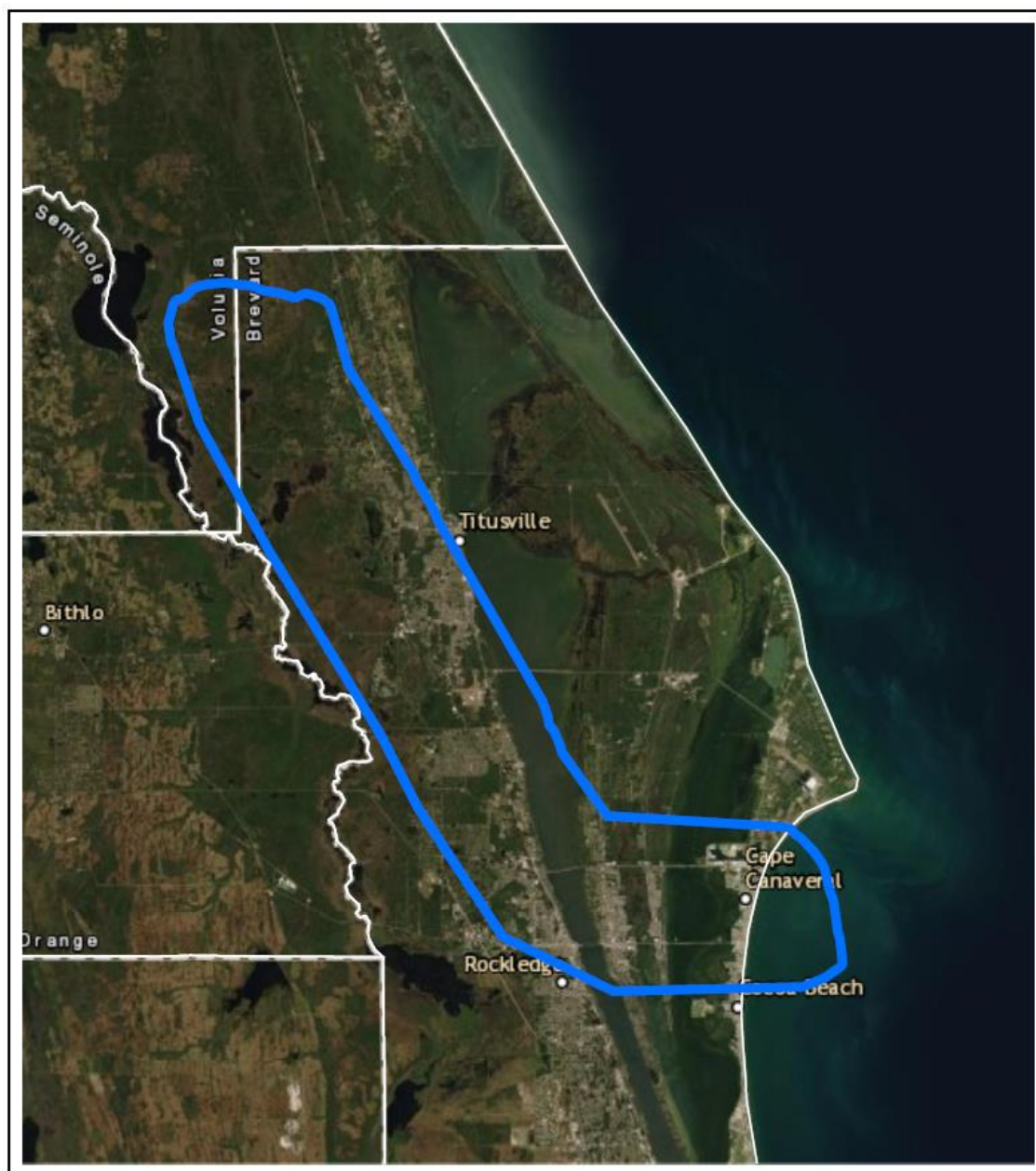
**Attachment 3: Reentry Vehicle Flight Path Approaches**



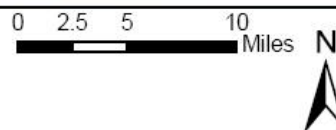
Source: SNC, 2019, Google, 2019.



**Attachment 4: Region of Influence**



Sources: ESRI, 2019; RS&H, 2019



**Legend**

— Region of Influence

**Agency Coordination List  
SLF Supplemental EA**

Agency	Contact Type	Last Name	First Name	Title	Phone	Email	Address	City	State	Zipcode
Brevard County	Consulting Agency	Elmore	Amanda	Planning and Zoning	321-633-2070 (x 5-2660)	<a href="mailto:Amanda.elmore@brevardfl.gov">Amanda.elmore@brevardfl.gov</a>	Viera Government Center 2725 Judge Fran Jamieson Way Building A	Viera	FL	32940
City of Titusville	Consulting Agency	Parrish	Brad	Planning and Growth Management	321-567-3776	<a href="mailto:bradley.parrish@titusville.com">bradley.parrish@titusville.com</a>	P.O. Box 2806 555 S. Washington Ave	Titusville	FL	32781-2803
EPA - Region 4	Consulting Agency	Militscher	Christopher	Region 4	404-562-9512	<a href="mailto:militscher.chris@epa.gov">militscher.chris@epa.gov</a>	Sam Nunn Atlanta Federal Center	Atlanta	GA	30303-8960
FAA (AST)	Lead Federal Agency	Zee	Stacey	Environmental Protection Specialist	202-267-9305	<a href="mailto:stacey.zee@faa.gov">stacey.zee@faa.gov</a>	800 Independence Ave SW	Washington	DC	20591
Florida Department of Environmental Protection Florida State Clearinghouse	Consulting Agency	Stahl	Chris	Clearinghouse Coordinator	850-717-9076	<a href="mailto:Chris.Stahl@dep.state.fl.us">Chris.Stahl@dep.state.fl.us</a>	2600 Blair Stone Road, MS 47	Tallahassee	FL	32399
Florida Division of Historical Resources	Consulting Agency	Parsons, PH.D., RPA	Timothy	State Historic Preservation Officer and Director of Historical Resources	850-245-6300	<a href="mailto:Timothy.Parsons@DOS.MyFlorida.com">Timothy.Parsons@DOS.MyFlorida.com</a>	Bureau of Historic Preservation R.A. Gray Building 500 South Bronough Street	Tallahassee	FL	32399
Metropolitan Planning Organization	Consulting Agency	Kraum	Sarah	Space Coast Transportation Planning Organization (TPO) - Multi-modal Program Specialist	(321) 690-6890	<a href="mailto:sarah.kraum@brevardfl.gov">sarah.kraum@brevardfl.gov</a>	2725 Judge Fran Jamieson Way; Bldg. B; Room 105, MS #82	Melbourne	FL	32940
NASA KSC	Cooperating Agency	Dankert	Don		321.861.1196	<a href="mailto:donald.j.dankert@nasa.gov">donald.j.dankert@nasa.gov</a>		John F. Kennedy Space Center	FL	32899
National Parks Service - Canaveral National Seashore (CANAS)	Cooperating Agency	Kneifl	Kristen	Resource Management Specialist	321-267-1110 x14	<a href="mailto:kristen_kneifl@nps.gov">kristen_kneifl@nps.gov</a>	Canaveral National Seashore 212 S. Washington Ave.	Titusville	FL	32796
Regional Planning Council	Consulting Agency	McCue, AICP	Tara	East Central Florida Regional Planning Council - Director or Planning and Community Development	407-245-0300	<a href="mailto:tara@ecfrpc.org">tara@ecfrpc.org</a>	455 N. Garland Avenue, Fourth Floor	Orlando	FL	32801
U.S. Air Force's 45th Space Wing	Cooperating Agency	Long	Eva	NEPA Project Manager		<a href="mailto:eva.long@usaf.af.mil">eva.long@usaf.af.mil</a>	45CES/CEIE1224 Jupiter St.	Patrick AFB	FL	32925
US Army Corps of Engineers	Consulting Agency	Collins	Jeff	Project Manager	321-504-3771 x13	<a href="mailto:Jeffrey.S.Collins@usace.army.mil">Jeffrey.S.Collins@usace.army.mil</a>	Department of the Army, Jacksonville District Corps of Engineers, Cocoa Permits Section, 400 High Point Drive, Suite 600	Cocoa	FL	32926
US Fish and Wildlife Service	Cooperating Agency	Ehrhardt	Cheri M.	Natural Resource Planner	321-593-2516 cell 321-861-2368 office	<a href="mailto:cheri_ehrhardt@fws.gov">cheri_ehrhardt@fws.gov</a>	PO Box 2683	Titusville	FL	32781
US Fish and Wildlife Service (Merritt Island NWR)	Cooperating Agency	Hamilton	Layne L.	Refuge Manager	321-861-2278 321-403-9213 (cell)	<a href="mailto:layne_hamilton@fws.gov">layne_hamilton@fws.gov</a>	Merritt Island National Wildlife Refuge Complex US Fish and Wildlife Service PO Box 2683	Titusville	FL	32781

**Agency Coordination List  
SLF Supplemental EA**

Agency	Contact Type	Last Name	First Name	Title	Phone	Email	Address	City	State	Zipcode
Catawba Indian Nation		Haire	Wenonah George	THPO	803-328-2427 x224	<a href="mailto:wenonahh@ccppcrafts.com">wenonahh@ccppcrafts.com</a>	996 Avenue of the Nations	Rock Hill	SC	29730
Chitimacha Tribe of Louisiana		Walden	Kimberly S.	THPO	337-923-9923	<a href="mailto:THPO@chitimacha.gov">THPO@chitimacha.gov</a>	P.O. Box 661	Charenton	LA	70523
Coushatta Tribe of Louisiana		Langley	Linda	THPO	337-584-1560	<a href="mailto:llangley@coushattatribela.org">llangley@coushattatribela.org</a>	P.O. Box 10	Elton	LA	70532
Eastern Band of Cherokee Indians		Townsend	Russell	THPO	828-554-6851	<a href="mailto:rustown@nc-chokeee.com">rustown@nc-chokeee.com</a>	P.O. Box 455	Cherokee	NC	28719
Jena Band of Choctaw Indians		Shively	Alina	THPO	318-992-1205	<a href="mailto:ashively@jenachoctaw.org">ashively@jenachoctaw.org</a>	PO Box 14	Jena	LA	71342
Miccosukee Tribe of Indians of Florida		Dayhoff	Fred	Historical Preservation Officer	239-695-4360		HC61SR68 Old Loop Road	Ochopee	FL	34141
Muscogee (Creek) Nation		Butler	RaeLynn	THPO	918-732-7678	<a href="mailto:section106@mcn-nsn.gov">section106@mcn-nsn.gov</a>	P.O. Box 580	Okmulgee	OK	74447
Poarch Band of Creek Indians		Haikey	Larry	THPO	251-368-9136, ext. 2067	<a href="mailto:THPO@pci-nsn.gov">THPO@pci-nsn.gov</a>	5811 Jack Springs Road	Atmore	AL	36502
Seminole Nation of Oklahoma		Isham	Theodore	THPO	405-234-5218	<a href="mailto:isham.t@sno-nsn.gov">isham.t@sno-nsn.gov</a>	PO Box 1498	Wewoka	OK	74884
Seminole Tribe of Florida		Backhouse	Dr. Paul	THPO	863-983-6549	<a href="mailto:paulbackhouse@semtribe.com">paulbackhouse@semtribe.com</a>	30290 Josie Billie Highway, PMB 1004	Clewiston	FL	33440

yellow indicates correspondence was, or will be, sent via FAA (Stacey Zee email - 9/11/19 6:40 pm)



**Alberts, David**

---

**Sent:**  
**To:**  
**Subject:**

Thank you for the opportunity to comment on the NEPA letter. We reviewed the letter and do not have any comments.

Brad Parrish, AICP  
Planning Manager  
555 South Washington Avenue  
City of Titusville, FL 32796  
Direct 321.567.3776  
Planner of the Day 321.567.3782  
[www.titusville.com](http://www.titusville.com)

For the City's interactive zoning map, including updates on developments in Titusville please visit  
<http://titusville.maps.arcgis.com/home/index.html>

We are interested in your opinion. The Community Development Customer Service Survey can be found  
at <http://www.titusville.com/Page.asp?NavID=2118>.



---

**From:** Alberts, David <[David.Alberts@rsandh.com](mailto:David.Alberts@rsandh.com)>  
**Sent:** Friday, September 13, 2019 8:34 AM  
**To:** Parrish, Bradley <[Brad.Parrish@titusville.com](mailto:Brad.Parrish@titusville.com)>  
**Subject:** Shuttle Landing Facility - Supplemental EA - Early Agency Coordination

Good Morning,

The attachment is an NEPA Early Coordination Letter associated with the *Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing Facility, Cape Canaveral Spaceport, Florida*.

Your agency's review and comments are appreciated.

Sincerely,

David Alberts

Project Manager

**David E. Alberts**

Aviation Senior Environmental Manager

10748 Deerwood Park Blvd South, Jacksonville, FL 32256

O 904-256-2469 | M 904-307-7049

[david.alberts@rsandh.com](mailto:david.alberts@rsandh.com)

[rsandh.com](http://rsandh.com) | [Facebook](#) | [Twitter](#) | [LinkedIn](#) | [Blog](#)

**Stay up-to-date with our latest news and insights.**



**From:** [Pete Eggert](#)  
**To:** [Alberts, David](#)  
**Subject:** Fwd: Supplemental EA for Reentry Vehicles at the Shuttle Landing Facility Cape Canaveral Florida  
**Date:** Tuesday, October 22, 2019 10:54:05 AM

---

Begin forwarded message:

**From:** "Stahl, Chris" <Chris.Stahl@dep.state.fl.us>  
**Date:** October 22, 2019 at 10:30:29 AM EDT  
**To:** Pete Eggert <PEggert@spaceflorida.gov>  
**Subject:** Supplemental EA for Reentry Vehicles at the Shuttle Landing Facility Cape Canaveral Florida

The Florida State Clearinghouse has no comments or concerns for the proposed EA.

*Chris Stahl*

Chris Stahl, Coordinator  
Florida State Clearinghouse  
Florida Department of Environmental Protection  
3800 Commonwealth Blvd., M.S. 47  
Tallahassee, FL 32399-2400  
ph. (850) 717-9076  
[State.Clearinghouse@floridadep.gov](mailto:State.Clearinghouse@floridadep.gov)



**From:** [Gissentanna, Larry](#)  
**To:** [Alberts, David](#)  
**Cc:** [Kajumba, Ntale](#); [Buskey, Traci P.](#)  
**Subject:** RE: Scoping Comments for Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing  
**Date:** Thursday, October 17, 2019 9:58:26 AM

---

RE: Scoping Comments for the Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing Facility, Cape Canaveral Spaceport, FL

Dear Mr. Alberts,

The U.S. Environmental Protection Agency Region 4 is in receipt of the scoping document on the proposed preparation of a Supplemental Environmental Assessment (SEA) to evaluate the potential impacts of the Operation of Concept Reentry Vehicles at the Shuttle Landing Facility, Cape Canaveral Spaceport (SLF), Florida. The EPA understands that the Federal Aviation Administration issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Since the 2018 Environmental Assessment/Finding of No Significant Impact (EA/FONSI), Space Florida proposes to add concept reentry vehicle operations with new flightpaths to the Proposed Action.

The EPA's preliminary concerns at this time can be summarized to include the following areas: The SEA should address the potential impacts to air quality, water, wetlands, noise, energy, climate change, environmental justice, and children's health related to the increase in air traffic. Please keep the local community informed and involved throughout the project process; by having community meetings and updating the community through local and social media outlets.

We look forward to reviewing the SEA when it becomes available. The EPA requests at least 1 hard copies of the Draft and Final SEA, with an electronic version, i.e. website or CD/DVD. Please forward all hard/electronic copies to the address below.

Thank you for the opportunity to comment. If you have any questions, please contact us via email or the information below.

Sincerely,

*Larry O. Gissentanna*

Project Manager, DoD & Federal Facilities

U.S. Environmental Protection Agency/ Region 4  
Strategic Programs Office, NEPA Section  
61 Forsyth Street, SW  
Atlanta, GA 30303-8960  
Office: 404-562-8248  
[gissentanna.larry@epa.gov](mailto:gissentanna.larry@epa.gov)

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## **APPENDIX A-2 – SECTION 106 CONSULTATION**



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U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Office of Commercial Space Transportation

800 Independence Ave., SW  
Washington, DC 20591

March 2, 2020

Dr. Timothy Parsons  
State Historic Preservation Officer  
Florida Division of Historical Resources  
R.A. Gray Building  
500 South Bronough Street  
Tallahassee, Florida 32399-0250

Dear Dr. Parsons,

The FAA is initiating Section 106 consultation and soliciting concurrence on the proposed Area of Potential Effects (APE), described below. Space Florida is applying to the FAA for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport<sup>1</sup> in Brevard County, Florida. FAA issuance of an RSOL is considered a federal undertaking under the regulations of the Advisory Council for Historic Preservation (36 Code of Federal Regulations [CFR] § 800.16(y)) for Section 106 of the National Historic Preservation Act.

#### **Background**

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launch vehicles. The FAA issued a Finding of No Significant Impact (FONSI) based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations with new flightpaths to their site. The issuance of a RSOL and the associated reentries will be analyzed in a Supplemental Environmental Assessment (SEA).

#### **Project Activities**

Under the proposed project, the FAA would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry operations. The reentry vehicle expected to operate at SLF and analyzed in the SEA is similar to the Sierra Nevada Corporation (SNC) *Dream Chaser*<sup>®</sup> spacecraft. Table 1 summarizes the reentry vehicle parameters. Figure 1 shows a reentry vehicle and proposed operation.

---

<sup>1</sup> According to FL Statute 331.304, the Cape Canaveral Air Force Station and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

**Table 1: Reentry Vehicle Parameters**

Characteristic	Data
Vehicle Length	30 ft
Wingspan	27 ft
Gross Vehicle Weight	24,600 lbs
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 ft
Cross-Range Capability	± 700 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

<sup>1</sup> Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

**Figure 1: Reentry Vehicle and Operation**



Source: SNC, 2019.

Reentry vehicle operations would include up to 6 reentries annually over the five-year license term (see **Table 2**).

**Table 2: Estimated Annual Number of Reentries**

	2020	2021	2022	2023	2024
Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

The reentry vehicle would reenter the atmosphere from west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

#### **Area of Potential Effects**

In accordance with 36 CFR § 800.4(a)(1), an APE needs to be established for the proposed undertaking in consultation with your office. The FAA has defined an APE in consideration of both potential direct and indirect effects associated with proposed reentry operations.

The proposed APE encompasses about 280 square miles and includes portions of Brevard and Volusia counties. The APE also extends over a portion of the Atlantic Ocean. This APE is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot or greater. (Attachment 1)

The FAA requests your concurrence on the determination of the APE within 30 days. If you have any questions or need additional information on the project, please contact Ms. Stacey Zee of my staff at (202) 267-9305 or at [Stacey.Zee@faa.gov](mailto:Stacey.Zee@faa.gov). Thank you in advance for your input on this project.

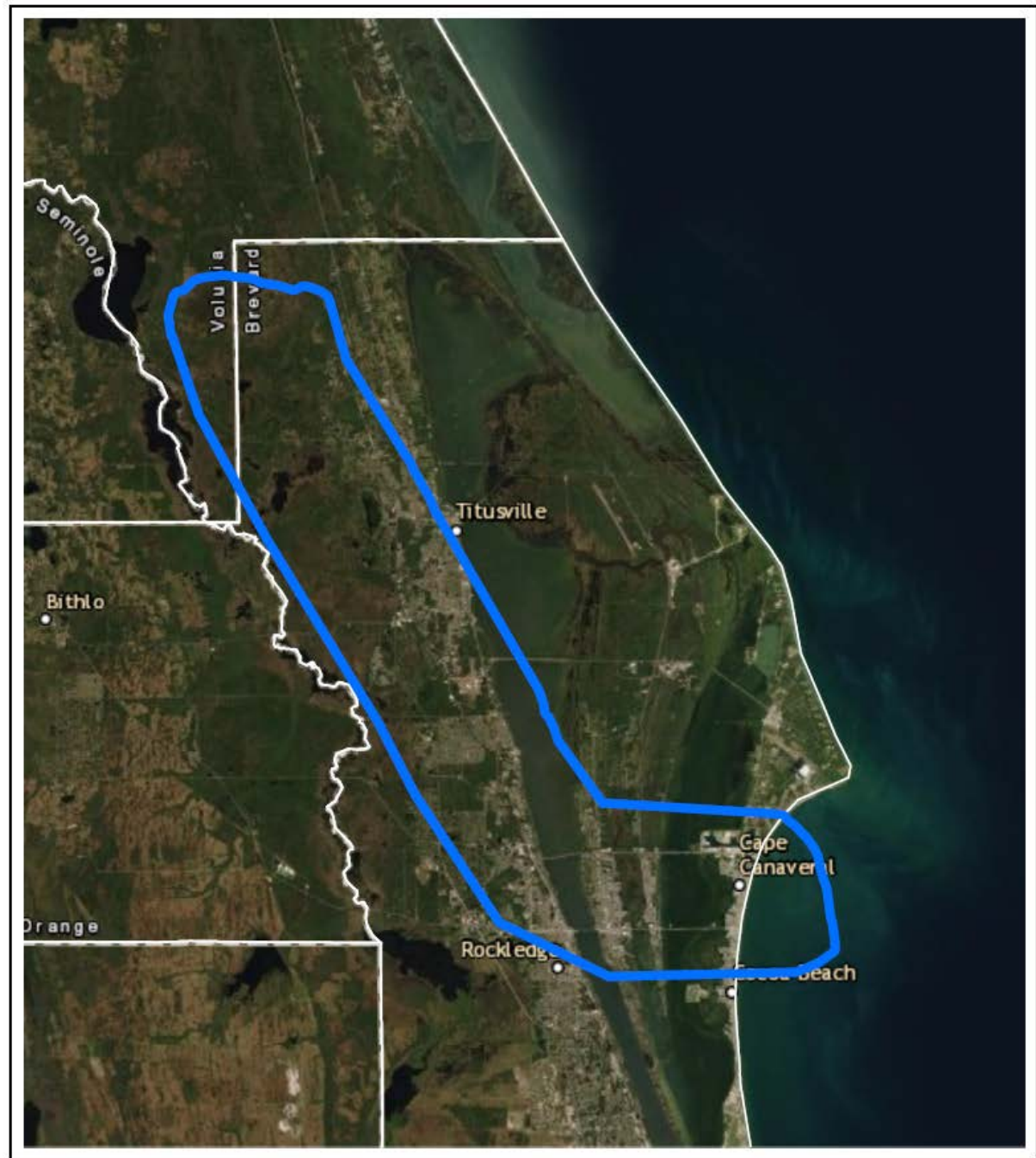
Sincerely,



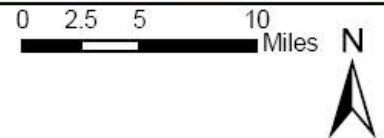
**Daniel Murray**  
Manager, Space Transportation Development Division

Enclosures:  
Attachment 1 – Area of Potential Effects

## Attachment 1 - Area of Potential Effects



Sources: ESRI, 2019; RS&H, 2019



### Legend





## FLORIDA DEPARTMENT of STATE

**RON DESANTIS**  
Governor

**LAUREL M. LEE**  
Secretary of State

Daniel Murray  
Manager, Space Transportation Development Division  
Office of Commercial Space Transportation  
800 Independence Ave., SW  
Washington, D.C. 20591

March 10, 2020

RE: DHR Project File No.: 2020-0991, Received by DHR: March 3, 2020  
*Area of Potential Effect Consultation - Space Florida, Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SFL) at the Cape Canaveral Spaceport, Brevard County, Florida*

Dear Mr. Murray:

The Florida State Historic Preservation Officer reviewed the referenced project for possible effects on historic properties listed, or eligible for listing, in the *National Register of Historic Places (NRHP)*. The review was conducted in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended, and its implementing regulations in *36 CFR Part 800: Protection of Historic Properties*.

The FAA notes that the proposed undertaking consists of a Reentry Site Operator License (RSOL) for Space Florida to operate a commercial space reentry site at the Shuttle Launch Facility at the Cape Canaveral Spaceport. The FAA recommends an area of potential effect (APE) for the undertaking including a 280 square mile area. The FAA defined the APE in consideration of both potential direct and indirect effects associated with proposed reentry operations. The FAA based the APE footprint on the reentry vehicle's sonic boom and includes those areas that would experience a sonic boom of 1.0 pound per square foot or greater.

Based on the information provided, our office concurs with the proposed APE and we look forward to continuing consultation with the FAA for this undertaking. If you have any questions, please contact me by email at [Jason.Aldridge@dos.myflorida.com](mailto:Jason.Aldridge@dos.myflorida.com) or by telephone at 850-245-6344.

Jason Aldridge  
Deputy State Historic Preservation Officer  
for Compliance and Review





U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Office of Commercial Space Transportation

800 Independence Ave., SW  
Washington, DC 20591

March 26, 2020

Dr. Timothy Parsons  
State Historic Preservation Officer  
Florida Division of Historical Resources  
R.A. Gray Building  
500 South Bronough Street  
Tallahassee, Florida 32399-0250

**RE: Finding of No Adverse Effect for Space Florida, Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport, Brevard County, Florida**

Dear Dr. Parsons,

As part of the Federal Aviation Administration's (FAA's) Section 106 review and pursuant to 36 CFR § 800.4, the FAA has undertaken identification efforts for the Space Florida RSOL for the SLF at the Cape Canaveral Spaceport. Based on the results of these efforts the FAA has determined a finding of No Adverse Effect is appropriate for this undertaking.

*Tribal Consultation:* The FAA initiated Section 106 consultation with the following Native American tribes: the Coushatta Tribe of Louisiana, the Miccosukee Tribe of Indians, and the Muscogee (Creek) Nation. All project documentation and this determination of effect letter has been provided to those tribes participating in the consultation.

*Area of Potential Effects:* The Area of Potential Effects (APE) for this undertaking is defined as an area encompassing 280 square miles, including portions of Brevard and Volusia counties and a portion of the Atlantic Ocean. This APE is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot or greater. This APE was reviewed and concurred upon by the State Historic Preservation Office (SHPO) in a letter dated March 10, 2020.

*Identification Efforts:* Research information on historic properties within the APE was obtained from the National Park Service (NPS) National Register of Historic Places (NRHP) and the Florida Master Site File. The Proposed Action does not include construction activities and therefore no additional survey work was performed.

*Historic Properties in the APE:* Historic, architectural, and cultural resources are sites recorded by the Florida Division of Historical Resources as Florida historical markers or resources that are in or eligible for listing in the National Register of Historic Places (NRHP). Table 1 lists the NHRP-eligible sites in the APE and Attachment 1 shows the location of these sites in relation to the APE.

**Table 1: NRHP Resources in the APE**

Resource Name	Resource Type
Aladdin Theater	Listed in NRHP
Barton Ave Residential District	Listed in NRHP
Cape Canaveral Air Force Station	Listed in NRHP
City Point Community Church	Listed in NRHP
Cocoa Junior High	Eligible for NRHP
Cocoa Post Office	Eligible for NRHP
Dr. George E Hill House	Listed in NRHP
J.R. Field, Homestead	Listed in NRHP
La Grange Church and Cemetery	Listed in NRHP
Porcher House	Listed in NRHP
Rockledge Drive Residential District	Listed in NRHP
Valencia Subdivision Residential Historic	Listed in NRHP

Sources: (NPS, National Register of Historic Places, 2019) (DHR, 2019)

*Finding of Effect:* Twelve (12) historic properties were identified in the project APE (Table 1 and Attachment 1).

No ground disturbing activities will occur in the APE. Operation of the reentry vehicles would increase flight activity at the SLF. The Proposed Action would not result air quality or visual (light or viewshed) impacts but the descent of reentry vehicles would generate a sonic boom. The Proposed Action would result in one sonic boom in 2020 and up to six sonic booms in 2024.

Potential impacts to historic resources were assessed by determining any potential direct and indirect impacts from noise and vibration that could potentially:

- Destroy or damage a historic property;
- Alter the character of the property's use, or physical features within the setting if the setting contributes to the property's qualification for the NRHP;
- Introduce visual, audible, or atmospheric features that would diminish the integrity of the property's historic features, if the setting contributes to the property's NRHP-eligibility; and/or Cause neglect of the property resulting in the property's deterioration or destruction.

Overpressure caused by extreme sonic booms has been associated with the potential for structural damage, specifically for brittle materials such as glass and plaster. The probability of a window breaking when exposed to a sonic boom with a 1.0 psf overpressure ranges from one in a billion to one in a million, depending on the condition of the glass, while the threshold for damage from overpressure on well-maintained structures is greater than 2 psf (BRRC, 2019<sup>1</sup>). The results of the sonic boom analysis indicated that the maximum overpressure associated with operation of the Proposed Action would be 1.1 psf, which is below the 2 psf threshold for damage on well-maintained structures.

<sup>1</sup> BRRC. (2019). *Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis*.

The potential for sonic boom impacts is also evaluated in relation to human annoyance and hearing conservation. The modeled maximum of 1.1 psf translates to an equivalent CDNL<sup>2</sup> of 41.2 dBC. Noise caused by the proposed reentry vehicle operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA).<sup>3</sup> The intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. It is estimated that, on average, each resident in the APE experiences the overpressure from a thunderstorm greater than 2.09 psf more than 20 times a year. Users of the historic properties located within the APE therefore likely experience similar levels of thunderstorm activity and noise impacts.

Based on the results of the studies and an assessment of effects to historic properties, the FAA has determined that this undertaking will have No Adverse Effect on historic properties. Please review this finding and the enclosed documentation, in accordance with 36 CFR § 800.5 and provide either your concurrence or non-concurrence within the 30-day regulatory time frame.

The documentation provided herein meets the regulatory standard for documenting this effect determination in accordance with 36 CFR § 800.5. If you have questions or concerns regarding this finding or the sufficiency of documentation, please contact Ms. Stacey Zee of my staff at (202) 267-9305 or at [Stacey.Zee@faa.gov](mailto:Stacey.Zee@faa.gov).

Sincerely,

Daniel Murray  
Manager, Space Transportation Development Division

Enclosures:

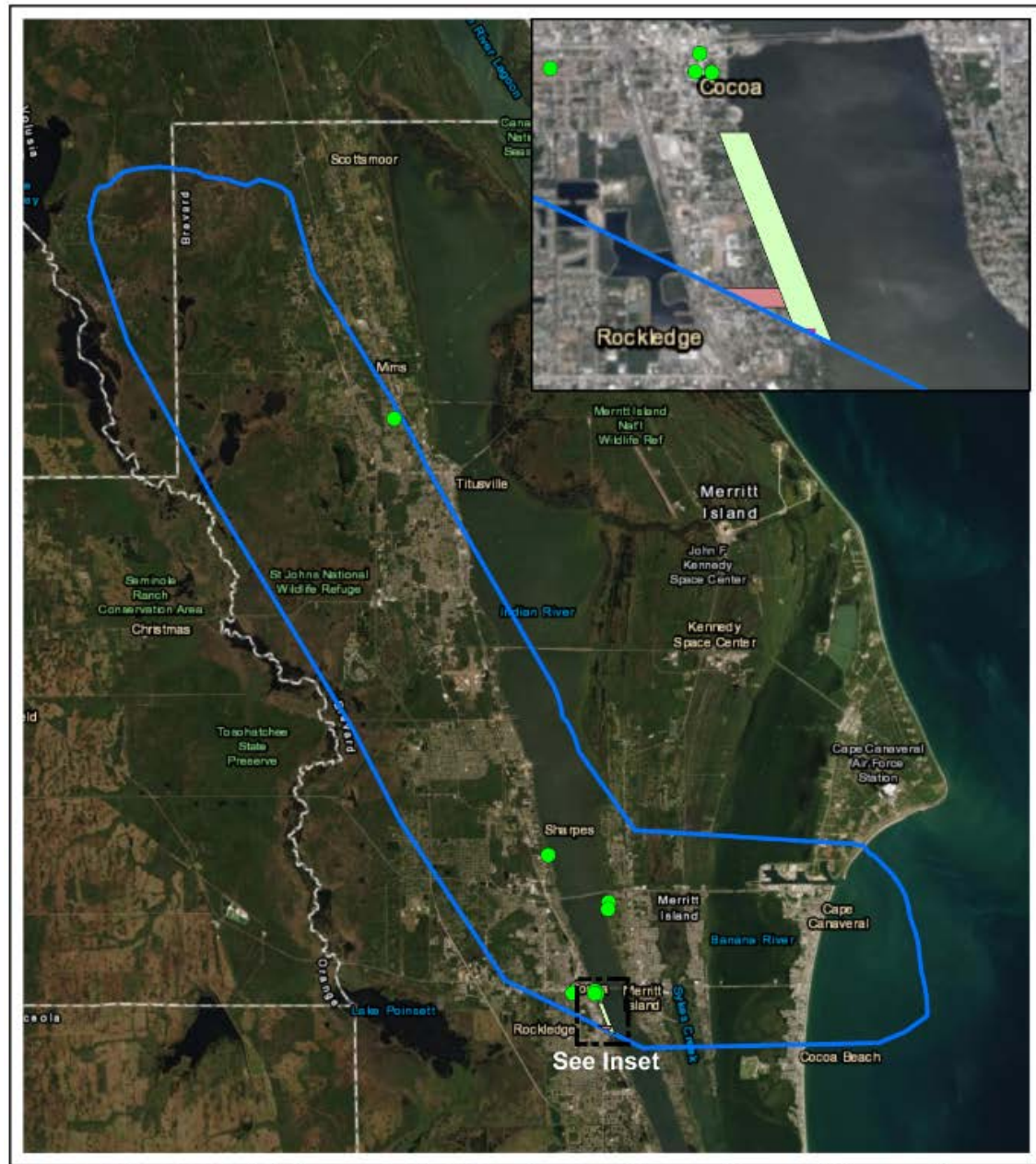
Attachment 1 – Historic Properties in the Area of Potential Effects

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<sup>2</sup> CDNL is the C-weighted Day-Night Level (DNL). C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.

<sup>3</sup> Areas exposed to DNL 65 dBA or lower are compatible with all land uses.

# Attachment 1 – Historic Properties in the Area of Potential Effects



Sources: Esri, 2019; RS&H, 2019; Florida Master Site File, 2019

0 2 4 8 12 16 Miles



## Legend

- Historic Resource
- Barton Avenue Historic District
- Rockledge Drive Residential District
- Valencia Subdivision Residential Historic
- Area of Potential Effect

**RS&H**



## FLORIDA DEPARTMENT of STATE

**RON DESANTIS**  
Governor

**LAUREL M. LEE**  
Secretary of State

Daniel Murray  
Manager, Space Transportation Development Division  
Office of Commercial Space Transportation  
800 Independence Ave., SW  
Washington, D.C. 20591

August 3, 2020

RE: DHR Project File No.: 2020-0991-B, Received by DHR: March 26, 2020  
*Finding of No Adverse Effect for Space Florida, Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SFL) at the Cape Canaveral Spaceport, Brevard County, Florida*

Dear Mr. Murray:

The Florida State Historic Preservation Officer reviewed the referenced project for possible effects on historic properties listed, or eligible for listing, in the *National Register of Historic Places (NRHP)*. The review was conducted in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended, and its implementing regulations in *36 CFR Part 800: Protection of Historic Properties*.

The FAA identified twelve historic properties within the undertaking's area of potential effect (APE). The FAA assessed potential effects to these resources related to noise and vibration generated by the undertaking. The FAA determined that the sonic booms generated by the undertaking will have no adverse effect to the identified historic properties, or other historic properties listed, or eligible for listing, in the NRHP.

Based on the information provided, our office concurs with the FAA's determination of no adverse effect to historic properties.

If you have any questions, please contact me by email at [Jason.Aldridge@dos.myflorida.com](mailto:Jason.Aldridge@dos.myflorida.com) or by telephone at 850-245-6344.

Sincerely,

Jason Aldridge  
Deputy State Historic Preservation Officer  
for Compliance and Review

## **APPENDIX A-3 – USFWS SECTION 7 CONSULTATION**

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U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Office of Commercial Space Transportation

800 Independence Ave., SW.  
Washington, DC 20591

March 2, 2020

Ms. Annie Dziergowski  
Chief, Project Review and Consultation  
U.S. Fish and Wildlife Service  
North Florida Ecological Services Office  
7915 Baymeadows Way, Suite 200  
Jacksonville, FL 32256-7517  
Submitted to: jaxregs@fws.gov

**SUBJECT:       Endangered Species Act Consultation for Proposed Reentry Operations at the Shuttle  
Landing Facility, Cape Canaveral Spaceport, Brevard County, Florida**

Dear Ms. Dziergowski,

The FAA is initiating Section 7 consultation and soliciting concurrence with our assessment and determination of the potential effects on ESA-listed species for the proposed reentry operations at the Shuttle Landing Facility (SLF). Space Florida is applying to the FAA for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport<sup>1</sup> in Brevard County, Florida (see **Figure 1** for project location).

The following sections of this letter provide a description of the action, define the action area, provide ESA-listed species and critical habitat in the action area, discuss potential effects to the listed species and critical habitat, and provide FAA's effect determination for each species and critical habitat.

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<sup>1</sup> According to FL Statute 331.304, the Cape Canaveral Air Force Station and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

**Figure 1. Project Location**



## Background

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The FAA issued a Finding of No Significant Impact (FONSI) and Record of Decision based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations, including operations of the Sierra Nevada Corporation Dream Chaser vehicle, with new flightpaths to their site.<sup>2</sup> The issuance of a RSOL and the associated reentries will be analyzed in a Supplemental Environmental Assessment (SEA).

In 2017, the FAA conducted ESA section 7 consultation with the USFWS for the FAA's action of issuing Space Florida a launch site operator license (FWS Log No. 04EF1000-2018-I-771). The FAA determined that operation of the SLF as a launch site and associated construction would have no effect on ESA-listed

<sup>2</sup> "Reentry vehicle" means a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact. 51 U.S.C. § 50902 (19)

species except the eastern indigo snake (*Dymarchon corais couperi*). The FAA determined the action proposed in 2017 may affect, but would not adversely affect, the eastern indigo snake. The USFWS concurred with this determination. The 2017 consultation did not include reentry vehicle operations.

#### Project Description

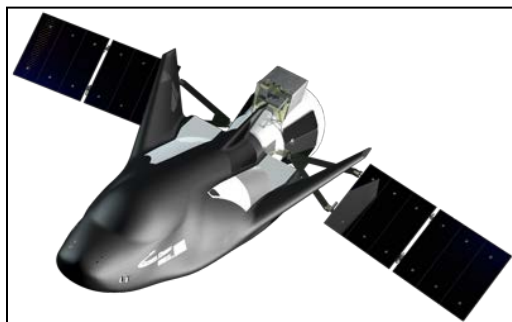
The FAA's Proposed Action is to issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry vehicle operations. Space Florida expects that the reentry vehicles that operate at SLF would be similar to Sierra Nevada Corporation's *Dream Chaser*® spacecraft. Table 1 summarizes the reentry vehicle parameters that will be evaluated in the SEA. Figure 1 shows a reentry vehicle and proposed operation.

**Table 1. Reentry Vehicle Parameters**

Characteristic	Data
Vehicle Length	30 feet
Wingspan	27 feet
Gross Vehicle Weight	24,600 pounds
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 feet
Cross-Range Capability	± 700 nautical miles
Propellants <sup>1</sup>	Hydrogen peroxide (H <sub>2</sub> O <sub>2</sub> ) and kerosene (RP-1)
Return Payload Capacity	1,850 kilograms

<sup>1</sup> Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

**Figure 1. Reentry Vehicle and Operation**





Space Florida is proposing a maximum of 6 reentries annually over the five-year license term (see **Table 2**).

**Table 2. Estimated Annual Number of Reentries**

2020	2021	2022	2023	2024
1	2	3	5	6

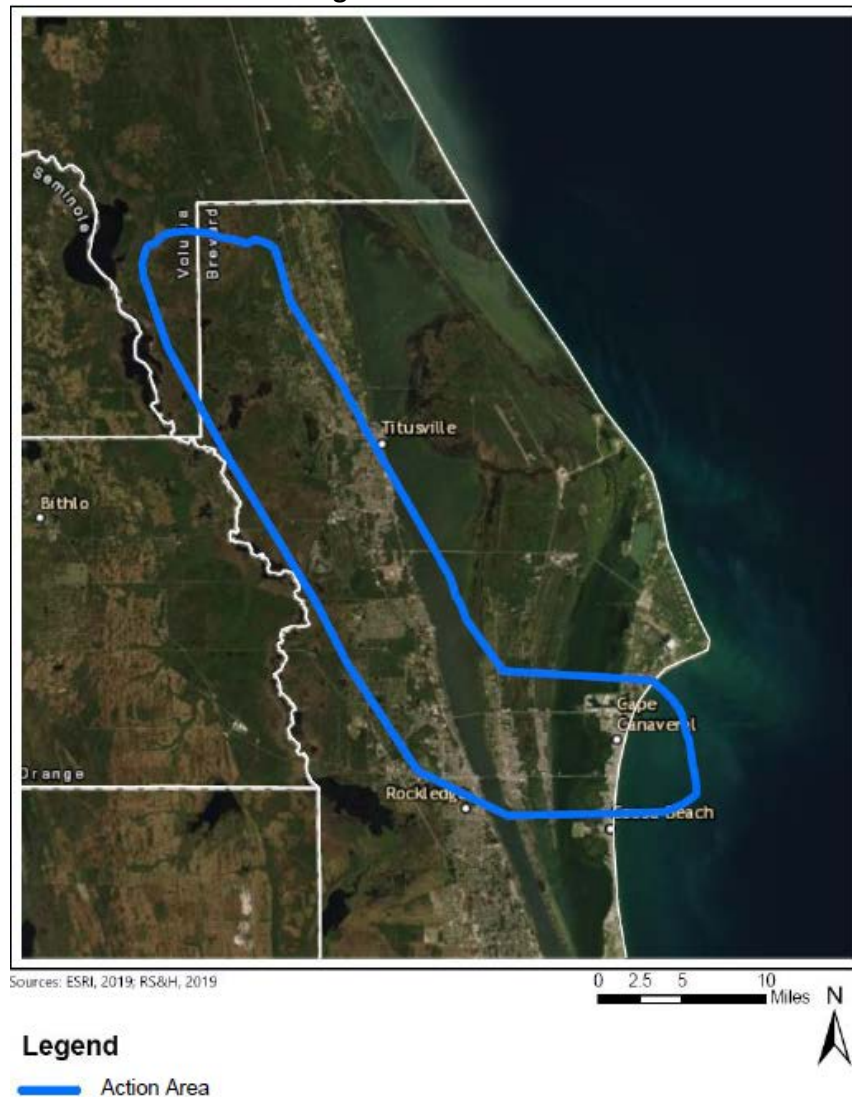
The reentry vehicle would reenter the atmosphere from the west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center (KSC) property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below an altitude of 60,000 feet above mean sea level (MSL) approximately 30–40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

### **Action Area**

The action area is defined as all areas directly or indirectly affected by the federal action. The action area is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot (psf) or greater. This approximately 280-square mile area encompasses portions of Brevard and Volusia counties (see Figure 2).

Figure 2. Action Area



### ESA-Listed Species and Critical Habitat

The FAA used the USFWS's Information for Planning and Consultation online system to generate a species list and identify critical habitat for the project. Table 3 includes ESA-listed species and critical habitat within the action area. Designated critical habitat for the West Indian manatee (*Trichechus manatus latirostris*) is present within the action area.

In 1977, the USFWS designated multiple waterways and parts of coastal Florida, from Jacksonville south to Miami and west around the peninsula to Tampa Bay, as critical habitat for manatees (42 FR 47840). The waters around KSC and Cape Canaveral Air Force Station (CCAFS) are critical habitat for the manatee. The Upper Banana River is an area of particular emphasis for cautious boat operations.

Table 3. ESA-Listed Species for the Action Area

Category	Species Common Name	Species Scientific Name	Status
Mammals	West Indian manatee	<i>Trichechus manatus latirostris</i>	E
	Southeastern beach mouse	<i>Peromyscus polionotus nineiventris</i>	T

Category	Species Common Name	Species Scientific Name	Status
Birds	Audubon's crested caracara	<i>Polyborus plancus audubinii</i>	T
	Eastern black rail	<i>Laterallus jamaicensis ssp. jamaicensis</i>	PT
	Everglade snail kite	<i>Rostrhamus sociabilis plumbeus</i>	E
	Florida scrub-jay	<i>Aphelocoma coerulascens</i>	T
	Piping plover	<i>Charadrius melodus</i>	T
	Wood stork	<i>Mycteria americana</i>	E
	Red knot	<i>Calidris canutus rufa</i>	T
	Red-cockaded woodpecker	<i>Picoides borealis</i>	E
Reptiles	Atlantic salt marsh snake	<i>Nerodia clarkii (fasciata)taeniata</i>	T
	Eastern indigo snake	<i>Dymarchon corais couperi</i>	T
	Gopher tortoise	<i>Gopherus polyphemus</i>	C
	Green sea turtle	<i>Chelonia mydas</i>	T
	Hawksbill sea turtle	<i>Eremochelys imbricata</i>	E
	Leatherback sea turtle	<i>Dermochelys coriacea</i>	E
	Loggerhead sea turtle	<i>Caretta caretta</i>	T
Plants	Carter's mustard	<i>Warea carteri</i>	E
	Lewton's polygala	<i>Polygala lewtonii</i>	E
	Okeechobee gourd	<i>Cucurbita okeechobeensis</i>	E
	Rugel's pawpaw	<i>Deeringthamnus rugelii</i>	E

C = candidate; E = endangered; PT = proposed threatened; T = threatened

Source: USFWS 2019.

### Potential Effects to ESA-listed Species and Critical Habitat

The Proposed Action would have no effect on the West Indian manatee's critical habitat because the action does not involve any activities within or near the critical habitat. Similarly, the Proposed Action would have no effect on ESA-listed plants in the action area because the action does involve activities with the potential to affect these plants.

Reentry operations have the potential to affect ESA-listed species in the action area, mainly from noise, including sonic booms. Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary. Primary effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci et al. 1988). Although the effects are likely temporal, sonic booms may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Sonic booms may mask or interfere with these functions.

Secondary effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Tertiary effects are the direct result of primary and secondary effects, and include population decline and habitat loss. Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey

base, ground-based disturbance) also influence secondary and tertiary effects, and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region. Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci et al. 1988; Bowles 1995).

Many scientific studies have investigated the effects of sonic booms on wildlife, and some have focused on wildlife “flight” due to noise. Natural factors which affect reaction include season, group size, age and sex composition, on-going activity, motivational state, reproductive condition, terrain, weather, and temperament (Bowles 1995). Individual animal response to a given noise event or series of events also can vary widely due to a variety of factors, including time of day, physical condition of the animal, physical environment, the experience of the individual animal with noises, and whether or not other physical stressors (e.g., drought) are present (Manci et al. 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the Manci et al. (1988) literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the “startle response.” The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci et al. (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

The following discussion presents a summary of some of the more relevant studies addressing the potential impacts to wildlife from sonic booms.

Teer and Truett (1973) tested quail eggs subjected to sonic booms at 2, 4, and 5.5 pounds per square foot (psf) and found no adverse effects. Heinemann and LeBrocq (1965) exposed chicken eggs to sonic booms at 3–18 psf and found no adverse effects. In a mathematical analysis of the response of avian eggs to sonic boom overpressures, Ting et al. (2002) determined that it would take a sonic boom of 250 psf to crack an egg. Bowles (1995) states that it is physically impossible for a sonic boom to crack an egg because one cannot generate sufficient sound pressure in air to crack eggs.

Teer and Truett (1973) examined reproductive success in mourning doves, mockingbirds, northern cardinals, and lark sparrows when exposed to sonic booms of 1 psf or greater and found no adverse effects. Awbrey and Bowles (1990) in a review of the literature on the effects of aircraft noise and sonic booms on raptors found that the available evidence shows very marginal effects on reproductive success. Ellis et al. (1991) examined the effects of sonic booms (actual and simulated) on nesting peregrine falcons, prairie falcons, and six other raptor species. While some individuals did respond by leaving the nest, the response was temporary and overall there were no adverse effects on nesting. Lynch and Speake (1978) studied the effects of both real and simulated sonic booms on the nesting and brooding of eastern wild turkey in Alabama. Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick lifting of the head and apparent alertness for between 10 and 20 seconds. No apparent nest failure occurred as a result of the sonic booms.

The literature suggests that common animal responses to noise include the startle response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife



species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise and sonic booms.

The entirety of the sonic boom footprint would be approximately 1 psf or less, which is less than a clap of thunder. Previous ESA consultation between the U.S. Air Force and USFWS in the vicinity of SLF have concluded that sonic booms would not adversely affect ESA-listed species.

Based on the lack of observed adverse effects to wildlife in the studies mentioned above and the lack of known adverse effects to ESA-listed over decades of launch operations at KSC and CCAFS, the FAA expects that sonic booms associated with the Proposed Action ***may affect, but would not likely to adversely affect***, ESA-listed wildlife species in the action area.

#### **Conclusion**

In summary, the FAA anticipates reentry operations (sonic booms) ***may affect, but would not likely to adversely affect***, all of the ESA-listed wildlife species in Table 3. The FAA seeks your concurrence on our effect determination and welcomes any additional comments. Thank you for your assistance in this matter. Please provide your response to Stacey Zee via e-mail at [Stacey.Zee@faa.gov](mailto:Stacey.Zee@faa.gov).

Sincerely,



Daniel Murray  
Manager, Space Transportation Development Division

**From:** [Zee, Stacey \(FAA\)](#)  
**To:** [Pete Eggert](#); [Alberts, David](#)  
**Cc:** [Clarkson, Chelsea \(FAA\)](#); [Grey, Leslie \(FAA\)](#)  
**Subject:** FW: USFWS receipt confirmation of project consultation request Re: [EXTERNAL] Shuttle Landing Facility - Section 7 letter  
**Date:** Tuesday, March 3, 2020 1:07:17 PM

---

Receipt of USFWS ltr

**From:** Jacksonville Regulatory, FW4 <jaxregs@fws.gov>  
**Sent:** Tuesday, March 03, 2020 1:02 PM  
**To:** Zee, Stacey (FAA) <Stacey.Zee@faa.gov>  
**Subject:** USFWS receipt confirmation of project consultation request Re: [EXTERNAL] Shuttle Landing Facility - Section 7 letter

Thank you for contacting the project consultation section of the Service's North Florida Ecological Services Office in Jacksonville.

Do not reply to this automated response. This message simply confirms that we have received your e-mail.

Please allow a **minimum of 60-days** from date of project submission to our office before inquiring as to your project's review status. This allows time for your project submission to be received, complete intake processing, and staff assignment and initial review.

Requests are placed in different process tracks (technical assistance, informal consultations or formal consultations) and generally handled on a first-in, first-out basis within those tracks. Where statutory timelines apply every reasonable effort is made to comply with these timelines. However, these timelines assume all information required for us to complete our review/consultation is provided and no additional information is requested. Such requests for additional information, clarification or incomplete submissions can result in the temporary suspension of the timeline.

If you have not heard from us **after 60-days**, for quickest response submit a status request via e-mail to [jaxregs@fws.gov](mailto:jaxregs@fws.gov), or you may call our Project Consultation Section at 904.731.3336.

Your understanding and cooperation is appreciated.

\*\*\*\* We recently updated our information for those applicants seeking FEMA CLOMR clearance. Also, many project review/consultation requests may already be covered by an existing clearance or authorization. Please take a look on our website at <https://www.fws.gov/northflorida> - click the "Consultant & Landowner Tools" button on the left. \*\*\*\*

\*\*\*\*\* Address and telephone contact information is available on our website at <https://www.fws.gov/northflorida> - click the "Contact Us" button on the left. \*\*\*\*\*

--

\*\*\*\*\*

Project Consultation Section  
North Florida Ecological Services Office  
U.S. Fish & Wildlife Service  
TEL: 904.731.3336  
FAX: 904.731.3045  
[www.fws.gov/northflorida](http://www.fws.gov/northflorida)

***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Office of Commercial Space Transportation

800 Independence Ave., SW.  
Washington, DC 20591

March 2, 2020

Ms. Annie Dziergowski  
Chief, Project Review and Consultation  
U.S. Fish and Wildlife Service  
North Florida Ecological Services Office  
7915 Baymeadows Way, Suite 200  
Jacksonville, FL 32256-7517  
Submitted to: jaxregs@fws.gov

**SUBJECT:       Endangered Species Act Consultation for Proposed Reentry Operations at the Shuttle  
Landing Facility, Cape Canaveral Spaceport, Brevard County, Florida**

Dear Ms. Dziergowski,

The FAA is initiating Section 7 consultation and soliciting concurrence with our assessment and determination of the potential effects on ESA-listed species for the proposed reentry operations at the Shuttle Landing Facility (SLF). Space Florida is applying to the FAA for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport<sup>1</sup> in Brevard County, Florida (see **Figure 1** for project location).

The following sections of this letter provide a description of the action, define the action area, provide ESA-listed species and critical habitat in the action area, discuss potential effects to the listed species and critical habitat, and provide FAA's effect determination for each species and critical habitat.



FWS Log No \_\_\_\_\_

**The Service concurs with your effect determination(s)  
for resources protected by the Endangered Species  
Act of 1973, as amended (16 U.S.C. 1531 et seq.). This  
finding fulfills the requirements of the Act.**

For

Jay B. Herrington  
Field Supervisor

Date

<sup>1</sup> According to FL Statute 331.304, the Cape Canaveral Air Force Station and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

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## **APPENDIX A-4 – TRIBAL GOVERNMENT-TO-GOVERNMENT AND SECTION 106 CONSULTATION**

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Tribal Government-to-Government and Section 106 consultation letters (see following pages for an example) were sent to the following Tribal Historic Preservation Officers (THPOs):

<b>Native American Tribe</b>	<b>Name</b>	<b>Title</b>	<b>Email</b>	<b>Address</b>	<b>City</b>	<b>State</b>	<b>Zip Code</b>
Catawba Indian Nation	Wenonah G. Haire	THPO	<a href="mailto:caitlinh@ccppcrafts.com">caitlinh@ccppcrafts.com</a>	1536 Tom Steven Road	Rock Hill	SC	29730
Chitimacha Tribe of Louisiana	Kimberly Walden	THPO	<a href="mailto:kim@chitimacha.gov">kim@chitimacha.gov</a>	P.O. Box 661	Charenton	LA	70523
Coushatta Tribe of Louisiana	Linda Langley, Ph.D	THPO	<a href="mailto:llangley@coushattatribela.org">llangley@coushattatribela.org</a>	PO Box 10	Elton	LA	70532
Eastern Band of Cherokee Indians	Russel Townsend	THPO	<a href="mailto:russtown@nc-chokeee.com">russtown@nc-chokeee.com</a>	Qualla Boundary Reservation PO Box 455	Cherokee	NC	28719
Jena Band of Choctaw Indians	Alina Shively	THPO	<a href="mailto:ashively@jenachoctaw.org">ashively@jenachoctaw.org</a>	P.O. Box 14	Jena	LA	71342
Muscogee (Creek) Nation	RaeLynn Butler	THPO	<a href="mailto:section106@mcn-nsn.gov">section106@mcn-nsn.gov</a>	P.O. Box 580	Okmulgee	OK	74447
Poarch Band of Creek Indians	Robert Thrower	THPO	<a href="mailto:rthrower@pci-nsn.gov">rthrower@pci-nsn.gov</a>	5811 Jack Springs Road	Atmore	AL	36502
Seminole Tribe of Florida	Paul Backhouse, Ph.D	THPO	<a href="mailto:paulbackhouse@semtribe.com">paulbackhouse@semtribe.com</a>	30290 Josie Billie Hwy, PMB 1004	Clewiston	FL	33440



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Commercial Space Transportation

800 Independence Ave., SW.  
Washington, DC 20591

March 12, 2020

Wenonah G. Haire, Tribal Historic Preservation Officer  
Catawba Indian Nation  
1536 Tom Steven Road, Rock Hill, SC, 29730

**RE: Invitation for Government-to-Government Tribal Consultation for Section 106 review of Reentry Vehicle Operations at the Shuttle Landing Facility at Cape Canaveral Spaceport in Brevard County, Florida**

The Federal Aviation Administration (FAA) has received an application from Space Florida to conduct reentry vehicle operations at the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport in Brevard County, Florida. FAA issuance of a Reentry Site Operator License (RSOL) is considered a federal undertaking under the regulations of the Advisory Council for Historic Preservation (36 Code of Federal Regulations [CFR] § 800.16(y)) for Section 106 of the National Historic Preservation Act.

For your reference, a project description and map of the area of potential effects are enclosed with this letter. The proposed project and its associated activities are also subject to the National Environmental Policy Act (NEPA) and the FAA has initiated preparation of a Supplemental Environmental Assessment to meet its regulatory obligations. The agency intends to complete Section 106 in conjunction with the NEPA process.

The FAA has identified your tribe as potentially having an interest in the project area. Pursuant to Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments*, FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, and 36 CFR § 800.2(c)(2)(B)(ii), the FAA is seeking input on properties of cultural or religious significance that may be affected by the undertaking, and inviting you to participate in government-to-government consultation in the Section 106 consultation process.

Please contact Stacey Zee at 202-267-9305, or via email at [Stacey.Zee@faa.gov](mailto:Stacey.Zee@faa.gov) within 30 days of the receipt of this letter to confirm your intent to participate in this Section 106 consultation.

Sincerely,

**DANIEL P MURRAY** Digitally signed by DANIEL P MURRAY  
Date: 2020.03.31 09:33:02 -04'00'

Daniel Murray  
Manager, Space Transportation Development Division

Enclosures:

Attachment 1 – Project Description

Attachment 2 – Area of Potential Effects

## Attachment 1 – Project Description

### Background

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The FAA issued a Finding of No Significant Impact (FONSI) based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations with new flightpaths to the Proposed Action, which will be analyzed in a Supplemental Environmental Assessment (SEA).<sup>1</sup>

### Project Activities

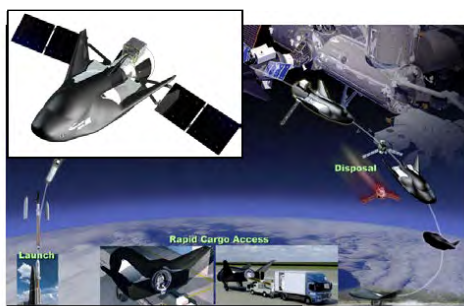
Under the proposed project, the FAA would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry operations. The reentry vehicle expected to operate at SLF and analyzed in the SEA is similar to the Sierra Nevada Corporation (SNC) *Dream Chaser*<sup>®</sup> spacecraft. **Table 1** summarizes the reentry vehicle parameters. **Figure 1** shows a reentry vehicle and proposed operation.

**Table 1: Reentry Vehicle Parameters**

Characteristic	Data
Vehicle Length	30 ft
Wingspan	27 ft
Gross Vehicle Weight	24,600 lbs
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 ft
Cross-Range Capability	± 700 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

<sup>1</sup> Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

**Figure 1: Reentry Vehicle and Operation**



<sup>1</sup> "Reentry vehicle" means a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact. 51 U.S.C. § 50902 (19)

Source: SNC, 2019.

Reentry vehicle operations would include up to 6 reentries annually over the five-year license term (see **Table 2**).

**Table 2: Estimated Annual Number of Reentries**

	2020	2021	2022	2023	2024
Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

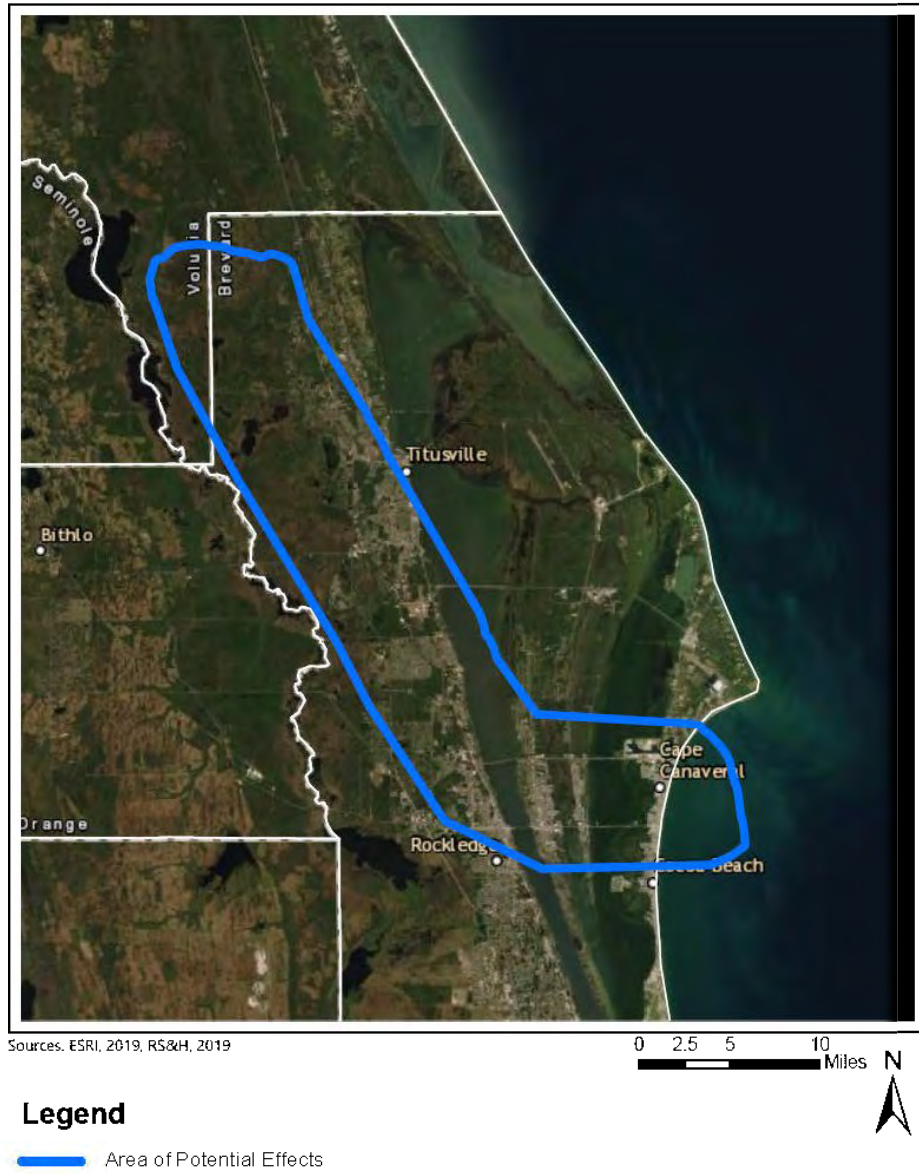
The reentry vehicle would reenter the atmosphere from west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

#### **Area of Potential Effects**

The FAA has defined an APE in consideration of both potential direct and indirect effects associated with proposed reentry operations.

The proposed APE encompasses about 280 square miles and includes portions of Brevard and Volusia counties. The APE also extends over a portion of the Atlantic Ocean. This APE is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot or greater. (Attachment 2)



Government-to-Government consultation letters (see following pages for an example) were sent to the following Native American Tribal leaders for tribes for which no THPO contact was available:

<b>Native American Tribe</b>	<b>Name</b>	<b>Title</b>	<b>Email</b>	<b>Address</b>	<b>City</b>	<b>State</b>	<b>Zip Code</b>
Miccosukee Tribe of Indians of Florida	Billie Colley	Chairman	<a href="mailto:HopeL@miccosukeetribe.com">HopeL@miccosukeetribe.com</a>	P.O. Box 440021	Miami	FL	33144
Seminole Nation of Oklahoma	Leonard Harjo	Chief	<a href="mailto:chief.prin@sno-nsn.gov">chief.prin@sno-nsn.gov</a>	PO Box 1498	Wewoka	OK	74884



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Commercial Space Transportation

800 Independence Ave., SW.  
Washington, DC 20591

March 12, 2020

Billie Colley, Chairman  
Miccosukee Tribe of Indians of Florida  
P.O. Box 440021, Miami, FL, 33144

**RE: Invitation for Government-to-Government Tribal Consultation for Reentry Vehicle Operations at the Shuttle Landing Facility at Cape Canaveral Spaceport in Brevard County, Florida**

The Federal Aviation Administration (FAA) has received an application from Space Florida to conduct reentry vehicle operations at the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport in Brevard County, Florida. In accordance with the National Environmental Policy Act (NEPA), the FAA issuance of a Reentry Site Operator License (RSOL) is considered a federal action. For your reference, a project description is enclosed with this letter. The FAA has initiated preparation of a Supplemental Environmental Assessment to meet its regulatory obligations.

The FAA has identified your tribe as potentially having an interest in the project area. Pursuant to Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments* and FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, the FAA is contacting your tribal leaders to initiate government-to-government consultation for this proposed action.

The FAA is seeking input on properties of cultural or religious significance that may be affected by the proposed action, and inviting you to participate in government-to-government consultation.

Please contact Stacey Zee at 202-267-9305, or via email at [Stacey.Zee@faa.gov](mailto:Stacey.Zee@faa.gov) within 30 days of the receipt of this letter to confirm your intent to participate in this government-to-government consultation.

Sincerely,

**DANIEL P MURRAY** Digitally signed by DANIEL P MURRAY  
Date: 2020.03.31 09:27:28 -04'00'

Daniel Murray  
Manager, Space Transportation Development Division

Enclosures:  
Attachment 1 – Project Description



## Attachment 1 – Project Description

### Background

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### Project Activities

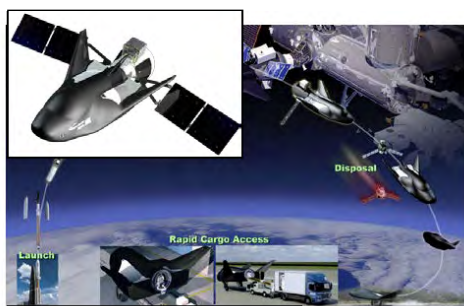
Under the proposed project, the FAA would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry operations. The reentry vehicle expected to operate at SLF and analyzed in the SEA is similar to the Sierra Nevada Corporation (SNC) *Dream Chaser*<sup>®</sup> spacecraft. **Table 1** summarizes the reentry vehicle parameters. **Figure 1** shows a reentry vehicle and proposed operation.

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Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

<sup>1</sup> Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

**Figure 1: Reentry Vehicle and Operation**



<sup>1</sup> "Reentry vehicle" means a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact. 51 U.S.C. § 50902 (19)

Source: SNC, 2019.

Reentry vehicle operations would include up to 6 reentries annually over the five-year license term (see **Table 2**).

**Table 2: Estimated Annual Number of Reentries**

	2020	2021	2022	2023	2024
Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

The reentry vehicle would reenter the atmosphere from west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

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## APPENDIX A-5 – STAKEHOLDER MEETINGS

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## **Stakeholder Outreach**

The Federal Aviation Administration's (FAA's) Office of Commercial Space Transportation (AST) is working to proactively engage stakeholders by initiating early and ongoing outreach efforts that span the life of the license application review process, including the pre-application consultation phase and prior to the associated environmental document's public review period.

### **June 2019**

AST organized meetings with internal FAA contacts and with agencies located near the Shuttle Landing Facility (SLF). In the meetings, Space Florida described their plans for the proposed reentry site and potential reentry operations. AST provided an overview of the licensing process.

- Intra-agency coordination: June 3, 2019 meeting with the Airport Planning and Environmental Division, Orlando Airport District Office, Command Center, and the SLF Jacksonville Air Route Traffic Control Center.
- Interagency meeting (Cooperating Agencies): In June 2019, AST met with agencies located near the SLF. The agencies provided points of contact for the project.
- Four agencies asked to be Cooperating Agencies for the environmental process:
  - The National Aeronautics and Space Administration (Kennedy Space Center)
  - US Air Force (Cape Canaveral Air Force Station)
  - US Fish and Wildlife (Merritt Island National Wildlife Refuge)
  - National Park Service (Cape Canaveral National Seashore and Atlanta-based regional staff)

### **June 2020**

AST met with Cooperating Agencies for the SLF Reentry Programmatic Environmental Assessment (EA). In this meeting, Space Florida and the Sierra Nevada Corporation (SNC) presented their proposed operations and proposed application timelines. AST described the planned stakeholder engagement approach for the project, the status of the environmental document, and the change in approach to a Programmatic EA.

### **September 2020**

On September 25, 2020, the FAA hosted a virtual meeting to provide information on Space Florida's proposed reentry site operations and to collect feedback from interested aviation groups (Air Line Pilots Association, Airlines for America, Airports Council International – North America, and the American Association of Airport Executives).

At the meeting, Space Florida summarized the history of reentry operations at the SLF and Space Florida's role as a state-chartered spaceport authority. Space Florida provided an overview of their proposed reentry site operations and SNC described the representative reentry vehicle (SNC's Dream Chaser) used for the analyses in the PEA. While SNC plans to apply to the FAA for a reentry license to conduct reentry operations at the SLF, the application has not yet been submitted and was therefore not discussed during the call or in this PEA.

The FAA provided an overview of the FAA's licensing process, focusing on the Reentry Site Operator License for which Space Florida has applied. FAA staff described the FAA's safety review, airspace integration, and environmental review that are a part of the FAA's license review process.

Aviation stakeholder groups were provided an opportunity to ask questions and suggest additional groups for the FAA to include in future stakeholder engagement efforts for Space Florida's proposed reentry site operations. Meeting participants were encouraged to sign up for the project mailing list through the FAA's stakeholder engagement website for this project:

[https://www.faa.gov/space/stakeholder\\_engagement/shuttle\\_landing\\_facility/public\\_involvement\\_opportunities/](https://www.faa.gov/space/stakeholder_engagement/shuttle_landing_facility/public_involvement_opportunities/).



*APPENDIX B: SLF REENTRY SITE LICENSING  
SONIC BOOM ANALYSIS*

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# Blue Ridge Research and Consulting, LLC

## *Technical Report*

# Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis

*May 2, 2019 (FINAL)*

**Prepared for:**

Brian Gulliver  
Kimley-Horn  
4582 South Ulster St, Suite 1500  
Denver, CO 80237

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**Prepared by:**

Michael James, M.S.  
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**Kimley-Horn Project Number:**

096627003.3 - Order #2  
SLF LSOL and RSOL

**BRRC Report Number:**

BRRC 19-01



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## Acronyms and Abbreviations

The following acronyms and abbreviations are used in the report:

BRRC	Blue Ridge Research and Consulting, LLC
CDNL	C-weighted DNL
dB	decibel
dBA	A-weighted decibel level
dBc	C-weighted decibel level
DNL	Day-Night Average Sound Level
FAA	Federal Aviation Administration
ft	foot/feet
KSC	Kennedy Space Center
NASA	National Aeronautics and Space Administration
NIHL	noise-induced hearing loss
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
psf	pounds per square foot
RSOL	Reentry Site Operator License
SEL	Sound Exposure Level in decibels
SLF	Shuttle Landing Facility
SNC	Sierra Nevada Corporation

## 1 Introduction

This report documents the sonic boom analysis performed as part of Space Florida's effort to obtain a Reentry Site Operator License (RSOL) at the Shuttle Landing Facility (SLF). The SLF is managed by Space Florida and is part of the John F. Kennedy Space Center (KSC), located on Merritt Island in Brevard County, Florida (Figure 1). Sierra Nevada Corporation (SNC) is proposing to conduct reentry operations of the Dream Chaser spacecraft (Figure 1) at the SLF. In addition to the Dream Chaser, the SLF could support other types of reentry vehicles, for a total of six reentry operations annually. For the purposes of the RSOL application, the Dream Chaser is utilized as a representative reentry vehicle for noise and sonic boom analysis. Sonic boom modeling was conducted for ten representative reentry azimuths to evaluate the potential for sonic boom impacts across the range of possible reentry trajectories.

The representative reentry vehicle will create sonic booms during its supersonic reentry. The potential for the boom to intercept the ground depends on the trajectory and speed of the vehicle as well as the atmospheric profile. The sonic boom is shaped by the physical characteristics of the vehicle and the atmospheric conditions through which it propagates. These factors affect the perception of a sonic boom. The noise is perceived as a deep double boom, with most of its energy concentrated in the low frequency range. Although sonic booms generally last less than one second, their potential for impact may be considerable.

This noise study describes the potential for sonic boom impacts associated with the representative reentry vehicle during reentry events. Section 2 summarizes the noise metrics discussed throughout this report; Section 3 describes the general methodology of the sonic boom modeling; Section 4 describes the modeling input parameters; and Section 5 presents the sonic boom modeling results. A summary is provided in Section 6 to document the notable findings of this noise study.



**Figure 1. Aerial view of the SLF and SNC's Dream Chaser spacecraft**

## 2 Noise Metrics and Criteria

### 2.1 Noise Metrics

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. Noise metrics are used to describe noise events and to identify potential impacts to receptors within the environment. These metrics are based on the nature of the event and who or what is affected by the sound. Noise sources can be continuous (constant) or transient (short-duration) and contain a wide range of frequency (pitch) content. Determining the character and level of sound aids in predicting the way it is perceived.

Sonic booms are classified as transient noise events and sonic boom levels are described in units of peak overpressure in pounds per square foot (psf). Sonic boom peak overpressures are used to assess single event noise impacts. Cumulative noise impacts are assessed using the Day-Night Average Sound Level (DNL) that accounts for the Sound Exposure Level (SEL) of all noise events in a 24-hour period. The SEL represents the cumulative noise exposure of a transient noise event and includes both its magnitude and its duration. Typically, DNL values are expressed as the level over a 24-hour annual average day. To account for increased human sensitivity to noise at night, a 10 dB adjustment is applied to nighttime events (occurring between the hours of 10:00 p.m. and 7:00 a.m.). Therefore, the DNL is dependent on the number of annual daytime and nighttime events.

### 2.2 Noise Criteria

Noise criteria have been developed to protect the public health and welfare of the surrounding communities. The impacts of sonic booms are evaluated on a cumulative basis in terms of human annoyance. In addition, the sonic boom impacts are evaluated on a single-event basis in relation to hearing conservation and structural damage criteria. Although Federal Aviation Administration (FAA) Order 1050.1F does not have guidance on hearing conservation or structural damage criteria, it recognizes the use of supplemental noise analysis to describe the noise impact and assist the public's understanding of the potential noise impact.

#### 2.2.1 Human Annoyance

A significant noise impact would occur if the "action would increase noise by DNL 1.5 dB[A] or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB[A] noise exposure level, or that will be exposed at or above this level due to the increase, when compared to the No Action Alternative for the same timeframe" [1]. A-weighted DNL is based on long-term cumulative noise exposure and has been found to correlate well with community annoyance for regularly occurring events including aircraft, rail, and road noise [2, 3]. For impulsive noise sources with significant low-frequency content such as sonic booms, C-weighted DNL (CDNL) is preferred over A-weighted DNL [4]. In terms of percent highly annoyed, DNL 65 dBA is equivalent to CDNL 60 dBC [5]. Additionally, it has been noted that DNL "threshold does not adequately address the effects of noise on visitors to areas within a national park or national wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute" [1]. DNL contours are provided as the most widely accepted metric to estimate the potential changes in long-term community annoyance.



### 2.2.2 Hearing Conservation

Multiple federal government agencies have provided guidelines on permissible noise exposure limits on impulsive noise such as sonic booms. These documented guidelines are in place to protect one's hearing from exposures to high noise levels and aid in the prevention of noise-induced hearing loss (NIHL). In terms of upper limits on impulsive or impact noise levels, National Institute for Occupational Safety and Health (NIOSH) [6] and Occupational Safety and Health Administration (OSHA) [7] have stated that levels should not exceed 140 dB peak sound pressure level, which equates to a sonic boom level of approximately 4 psf. KSC's Hearing Loss Prevention Program states that impact or impulse noise exposure levels should not exceed 130 dB peak sound pressure level, which equates to a sonic boom level of approximately 1.3 psf.

### 2.2.3 Structural Damage

Sonic booms can be associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table 1 summarizes the threshold of damage that may be expected at various overpressures [8]. Additionally, Table 1 describes example impulsive events for each level range. A large degree of variability exists in damage experience, and much of the damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. The probability of a window breaking at 1 psf ranges from one in a billion [9] to one in a million [10]. These damage rates are associated with a combination of boom load and glass condition. At 10 psf, the probability of breakage is between one in 100 and one in 1,000. Laboratory tests involving glass [11] have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms. However, in the real world, glass is not always in pristine condition.

Damage to plaster occurs at similar ranges to glass damage. Plaster has a compounding issue in that it will often crack due to shrinkage while curing or from stresses as a structure settles, even in the absence of outside loads. Sonic boom damage to plaster often occurs when internal stresses are high as a result of these factors. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf [8], below which damage is unlikely.

**Table 1. Possible damage to structures from sonic booms [8]**

Nominal level and comparative events	Damage Type	Item Affected
<i>0.5 – 2 psf</i> <i>Compares to piledriver at construction site</i>	Plaster	Fine cracks; extension of existing cracks; more in ceilings; over doorframes; between some plasterboards.
	Glass	Rarely shattered; either partial or extension of existing.
	Roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
	Other	Dust falls in chimneys.
<i>2 – 4 psf</i> <i>Compares to cap gun or firecracker near ear</i>	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
<i>4 – 10 psf</i> <i>Compares to handgun at shooter's ear</i>	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Inside ("party") walls known to move at 10 psf.
<i>&gt; 10 psf</i> <i>Compares to fireworks display from viewing stand</i>	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plasterboards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

### 3 Sonic Boom Modeling

When a vehicle moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the vehicle is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at ground level, a sonic boom consists of two shock waves (one associated with the forward part of the vehicle, the other with the rear part) of approximately equal strength and separated by 100 to 200 milliseconds. When plotted, this pair of shock waves and the expanding flow between them has the appearance of a capital letter “N,” so a sonic boom pressure wave is usually called an “N-wave.” An N-wave has a characteristic “bang-bang” sound that can be startling. Figure 2 shows the generation and evolution of a sonic boom N-wave under the vehicle.

Figure 3 shows the sonic boom pattern for a vehicle in steady, level supersonic flight. The boom forms a cone that is said to sweep out a “carpet” under the flight track. The boom levels vary along the lateral extent of the “carpet” with the highest levels directly underneath the flight track and decreasing as the lateral distance increases to the cut-off edge of the “carpet.” When the vehicle is maneuvering, the sonic boom energy can be focused in highly localized areas on the ground. The complete ground pattern of a sonic boom depends on the size, weight, shape, speed, and trajectory of the vehicle.

Sonic boom modeling and analysis utilize PCBoom software [12]. PCBoom calculates the magnitude and location of sonic boom overpressures on the ground from a vehicle in supersonic flight.

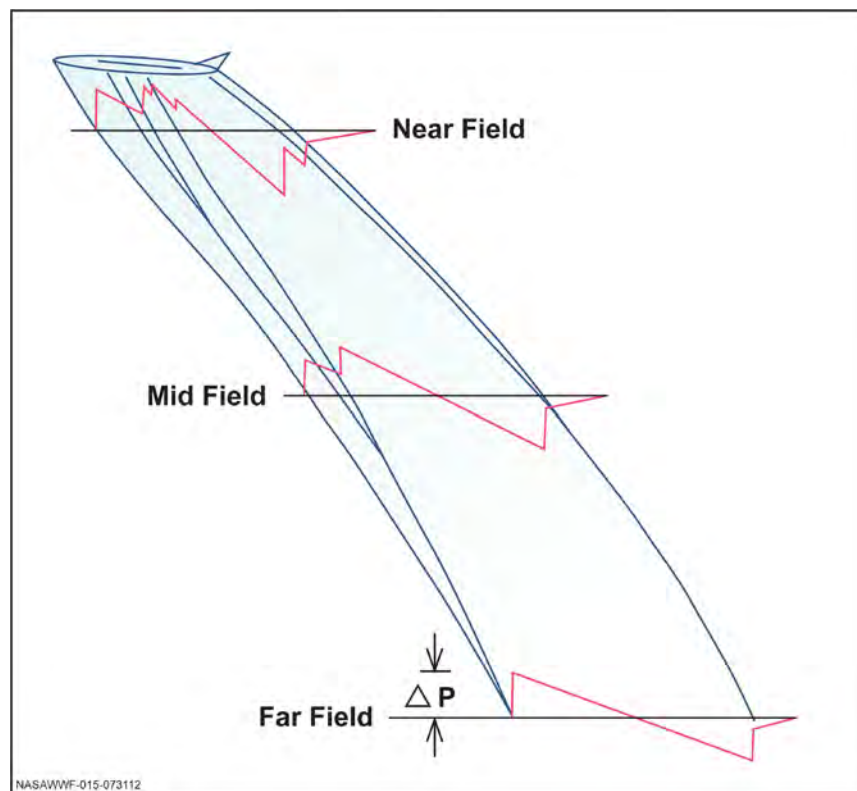
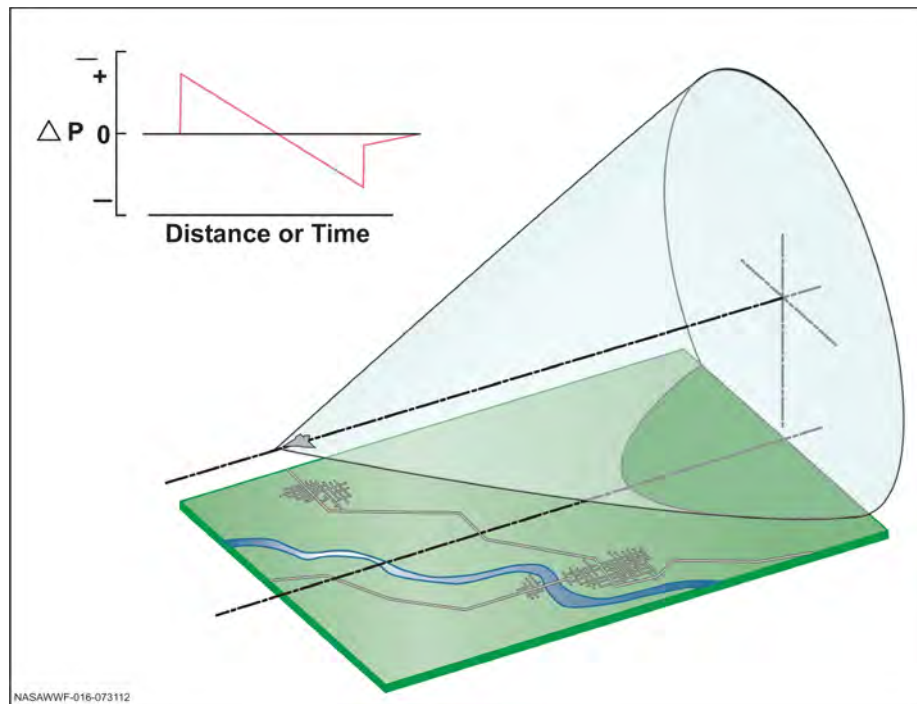


Figure 2. Sonic boom generation and evolution to N-wave [13]



**Figure 3. Sonic boom carpet for a vehicle in steady flight [14]**

## 4 Shuttle Landing Facility Modeling Input

### 4.1 Reentry Site Description

The SLF is an airport and spaceport located on Merritt Island in Brevard County, Florida and is part of NASA's KSC as shown in Figure 4. The SLF was designed and constructed in the 1970s to serve as the primary landing and recovery site for the Space Shuttle Orbiter. In 2013, NASA's KSC officially signed over management of the SLF to Space Florida. The runway's coordinates are provided in Table 2. The reentry site's atmospheric profile was developed from standard atmospheric data sources [15, 16, 17] to create a composite atmospheric profile for altitudes up to 62 miles.

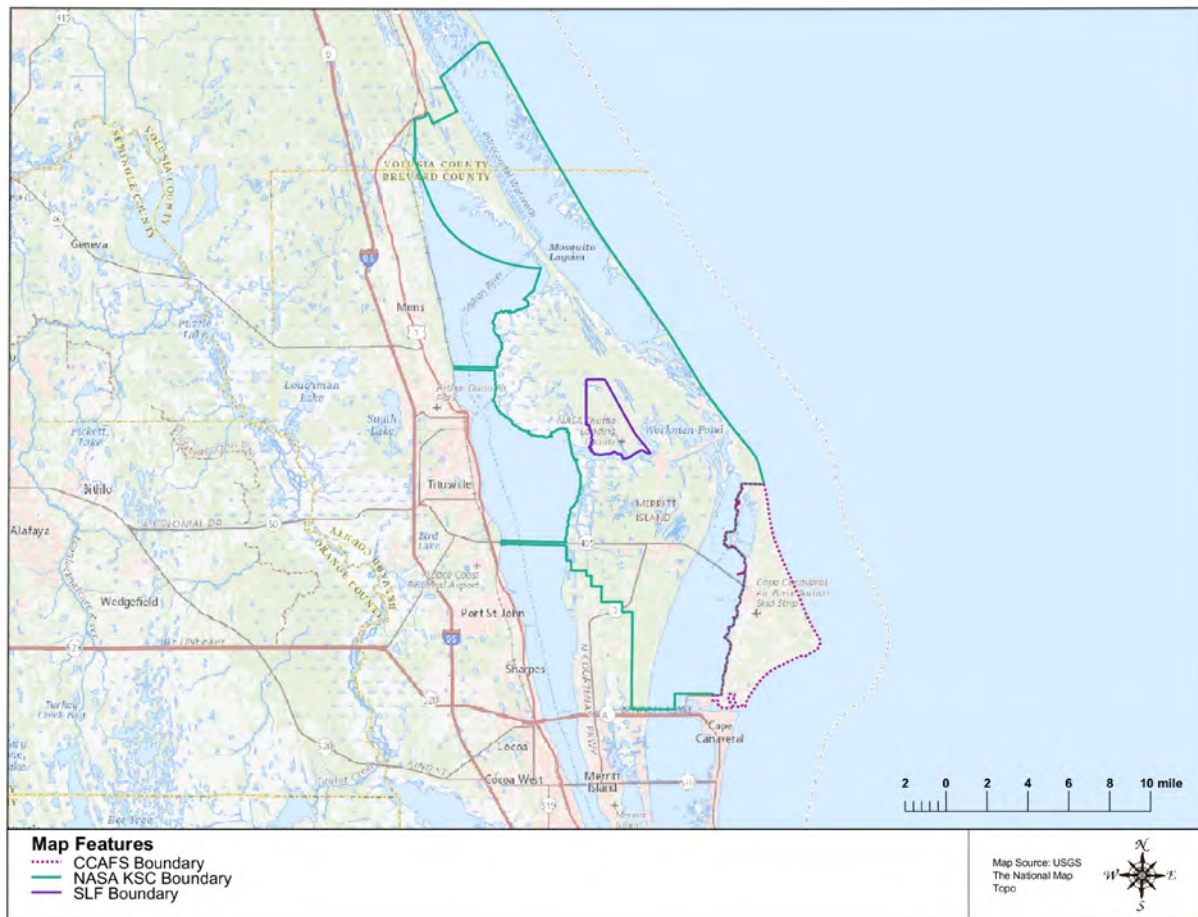


Figure 4. Site boundaries of Cape Canaveral Air Force Station (CCAFS), KSC, and SLF

Table 2. SLF runway coordinates

Runway ID	Start		End	
	Latitude	Longitude	Latitude	Longitude
Runway 15	28.632758° N	80.706064° W	28.597031° N	80.682683° W
Runway 33	28.597031° N	80.682683° W	28.632758° N	80.706064° W

## 4.2 Modeling Parameters

### 4.2.1 Vehicle Description

PCBoom requires specific vehicle input parameters to determine the sonic booms resulting from proposed reentry operations. For this analysis the Dream Chase spacecraft was chosen as the representative reentry vehicle and its parameters are presented in Table 3.

**Table 3. Vehicle parameters used in acoustic modeling**

Parameters	Values
Vehicle Description	SNC's Dream Chaser spacecraft
Vehicle Length	30 feet
Gross Vehicle Weight	24,600 lbs

### 4.2.2 Operational Data

The SLF is expected to support up to six reentries annually. Of the six total annual operations, two operations are projected to occur during acoustic nighttime hours (2200 – 0700).

### 4.2.3 Flight Trajectory Data

Reentry trajectories arriving to SLF will be unique to each mission and the environmental conditions. The proposed reentry operations span a range of possible reentry trajectories. For the purpose of assessing potential sonic boom impacts from vehicle reentries, a total of ten trajectories (five for each runway) have been provided by SNC to represent the range of reentry trajectories. The ten reentry trajectories are described in Table 4 and shown in Figure 5, where Runway 15 and Runway 33 trajectories are displayed in red and blue, respectively.

**Table 4. Trajectory descriptions**

Description
Runway 15 - Northern boundary of reentry trajectories
Runway 15 - Northern reentry trajectory
Runway 15 - Nominal reentry trajectory
Runway 15 - Southern reentry trajectory
Runway 15 - Southern boundary of reentry trajectories
Runway 33 - Northern boundary of reentry trajectories
Runway 33 - Northern reentry trajectory
Runway 33 - Nominal reentry trajectory
Runway 33 - Southern reentry trajectory
Runway 33 - Southern boundary of reentry trajectories





## 5 Results

The following section presents the noise study results of the sonic boom impacts associated with the representative reentry vehicle operations to the SLF. A sonic boom is the sound associated with the shock waves created by a vehicle traveling through the air faster than the speed of sound. The presence and/or location of sonic boom regions is highly dependent on the actual trajectory and atmospheric conditions at the time of flight.

The modeled sonic boom contours for the northern bounding trajectory, northern trajectory, nominal trajectory, southern trajectory, and southern bounding trajectory to Runway 15 are presented in Figure 6 through Figure 10, respectively. Similarly, the sonic boom contours for the five reentry trajectories to Runway 33 are presented in Figure 11 through Figure 15. Each figure presents the sonic boom contours for levels above 0.5 psf across Florida and Cuba along with an inset map that displays the entire extent of the 0.25 psf sonic boom contour over the Pacific Ocean. The modeled sonic boom contours are presented for contours levels between 0.25 psf and 1 psf. In addition to the contours, the black ground path in the figures show the portion of supersonic flight during each event that generate sonic boom footprints that intercept the ground. Note, the Dream Chaser spacecraft is subsonic before it turns to its final approach.

The potential for sonic boom impacts over the entire range of reentry trajectories is represented by 'envelope' contours as presented in Figure 16. The 'envelope' contours represent the maximum peak overpressure predicted for any trajectory flown within the range of potential reentry azimuths. The area impacted by a single trajectory will be much smaller as shown in Figure 6 through Figure 15. A summary of the modeled 'envelope' sonic boom peak overpressure results presented in Figure 16 is detailed below.

- Land areas within the 'envelope' sonic boom contours include central/southern Florida, the Louisiana coast, southeast Texas, Mexico, Central America, the Galapagos Islands, western Cuba, and the islands of Bimini and the Cay Sal Bank in the Bahamas. The predicted overpressure levels for a vast majority of this area are between 0.25 and 0.5 psf, comparable to distant thunder.
- Land area in portions of Florida and Northwestern Cuba may experience levels greater than 0.5 psf. Sonic boom peak overpressures between 1.0 and 1.1 psf may be experienced by communities along the Florida Space Coast, including Cape Canaveral, Merritt Island, Cocoa, Port St John, and Titusville.

The modeled maximum peak overpressure is approximately 1.1 psf over all trajectories. A modeled maximum of 1.1 psf translates to an equivalent CDNL of 41 dBA for the maximum projected reentry operation tempo. Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure is less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). The potential for hearing damage (with regards to humans) is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criteria. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

Although the proposed reentry operations do not pose significant impacts in relation to human annoyance, hearing conservations, or structural damage; the unexpected, loud impulsive noise of sonic



booms tend to cause a startle effect in people. However, when humans are exposed to impulse noises with similar characteristics on a regular basis, they tend to become conditioned to the stimulus and the resulting startle reaction is generally not displayed. The physiological effects of single sonic booms on humans [18] for the levels produced by the representative reentry vehicle can be grouped as presented in Table 5.

**Table 5. Physiological effects of single sonic booms on humans [18]**

Sonic boom overpressure	Behavioral effects
0.3 psf	Orienting, but no startle response; eyeblink response in 10% of subjects; no arm/hand movement.
0.6 – 2.3 psf	Mixed pattern of orienting and startle responses; eyeblink in about half of subjects; arm/hand movements in about a fourth of subjects, but not gross bodily movements.

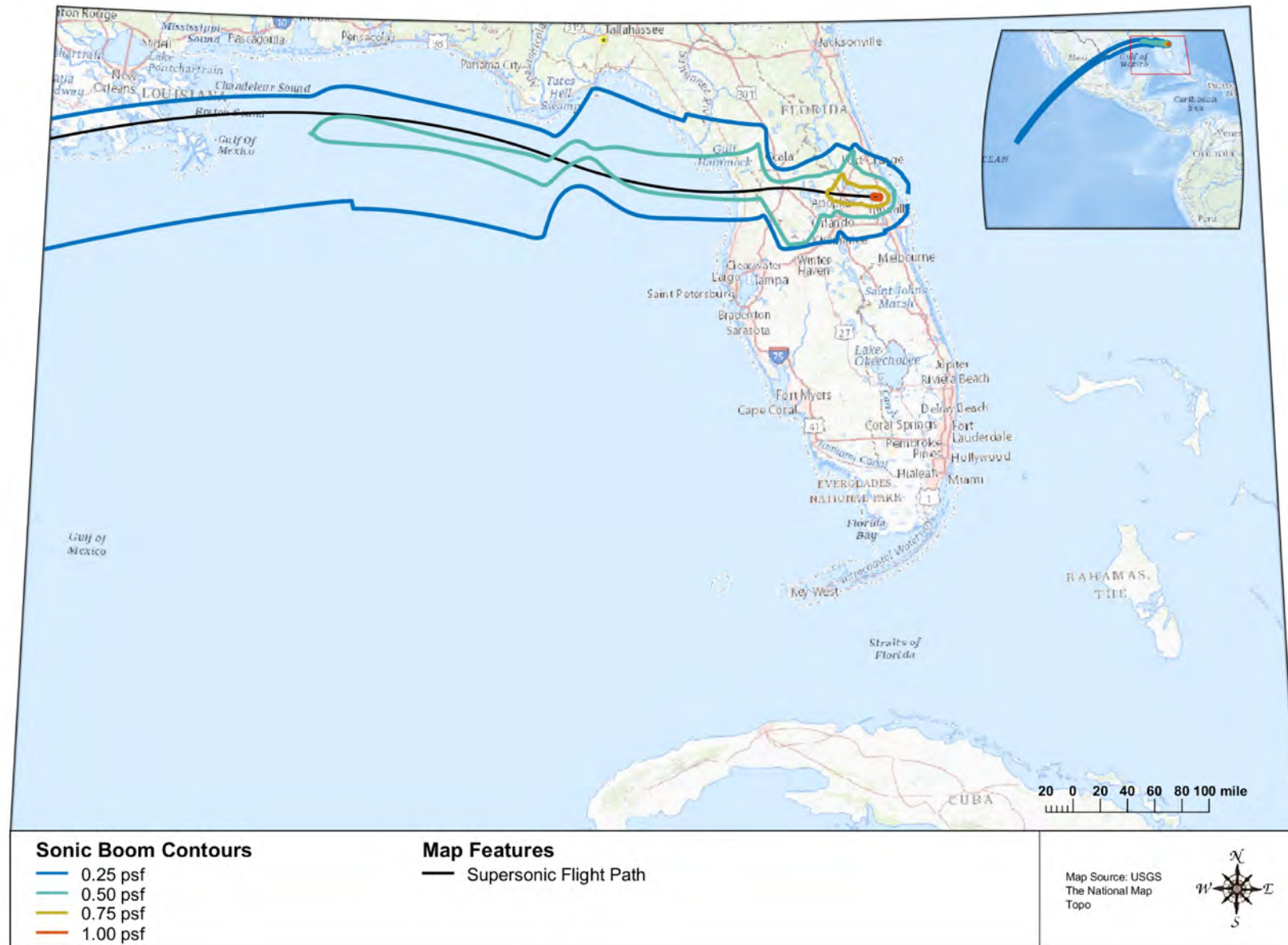


Figure 6. Sonic boom contours for the northern boundary of reentry trajectories to Runway 15

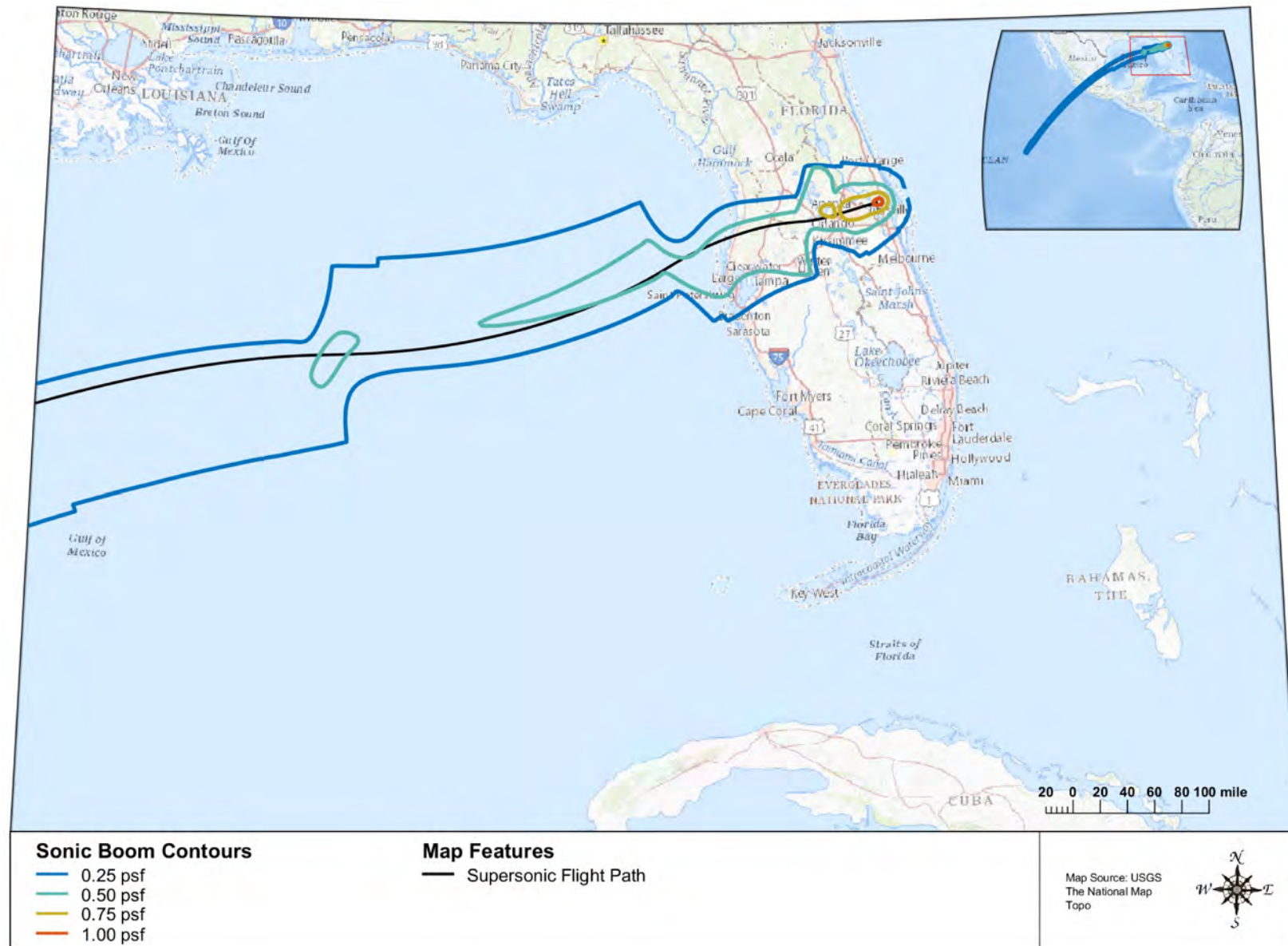


Figure 7. Sonic boom contours for the northern reentry trajectory to Runway 15

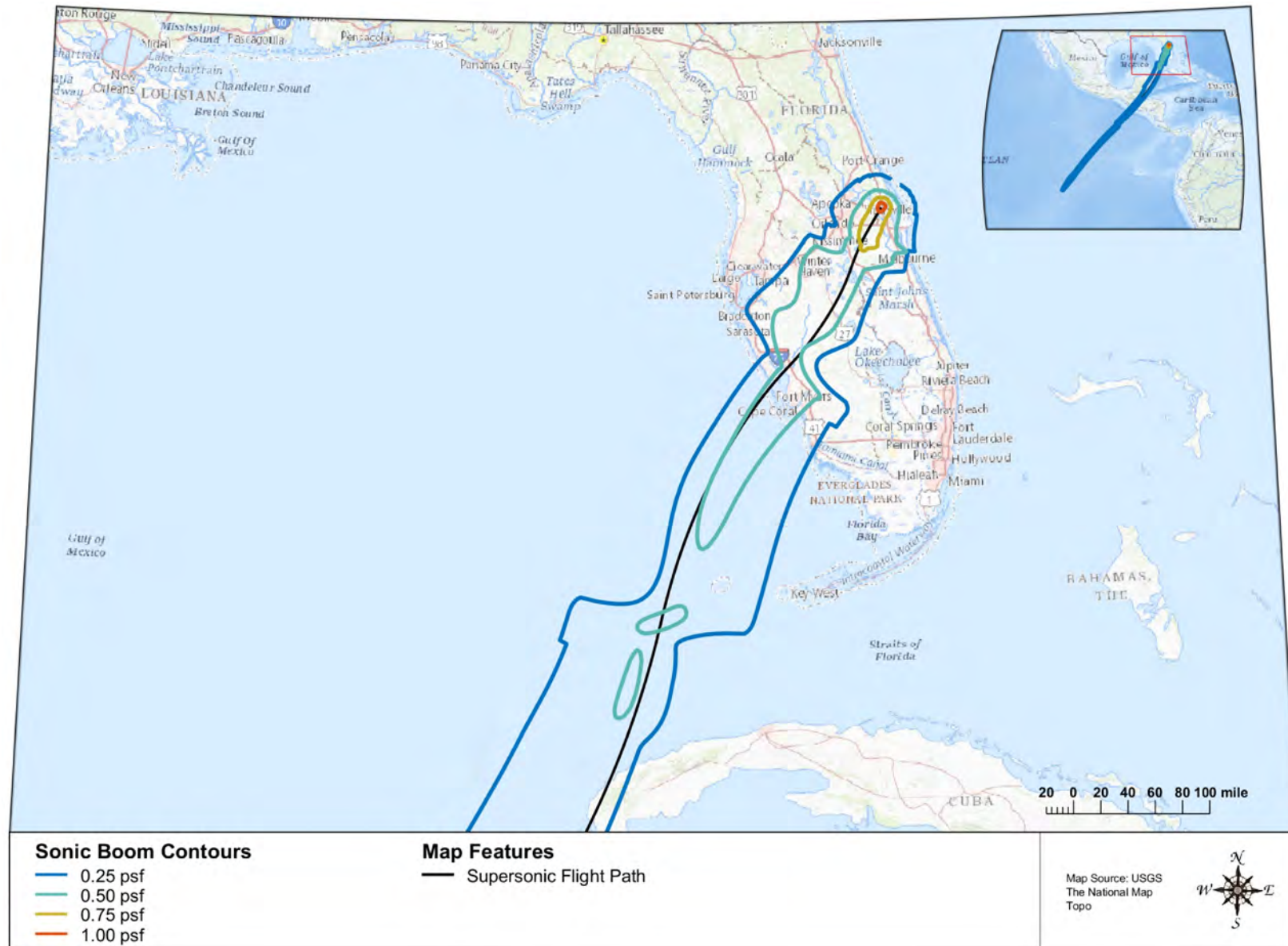


Figure 8. Sonic boom contours for the nominal trajectory to Runway 15



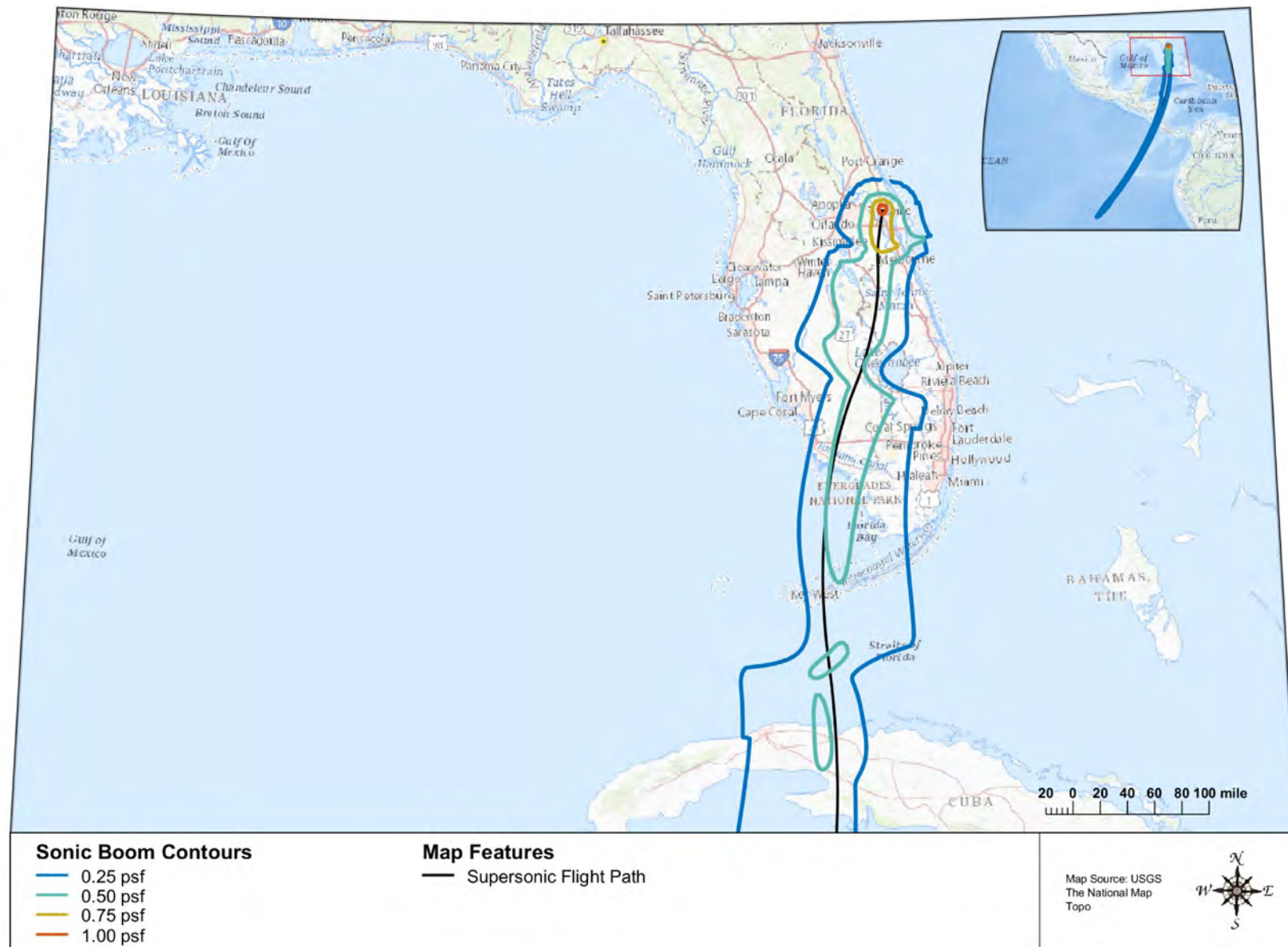


Figure 9. Sonic boom contours for the southern reentry trajectory to Runway 15

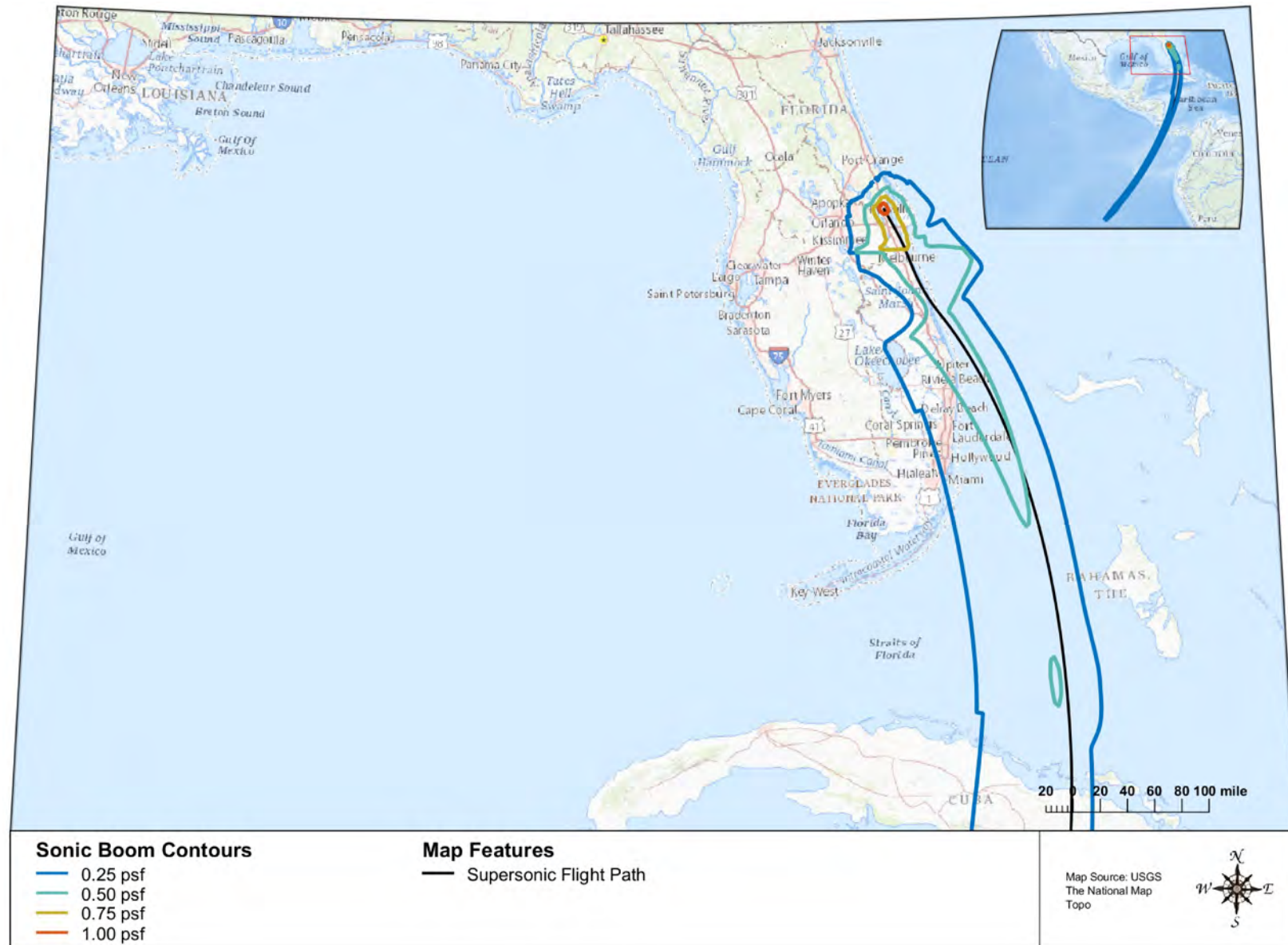


Figure 10. Sonic boom contours for the southern boundary of reentry trajectories to Runway 15

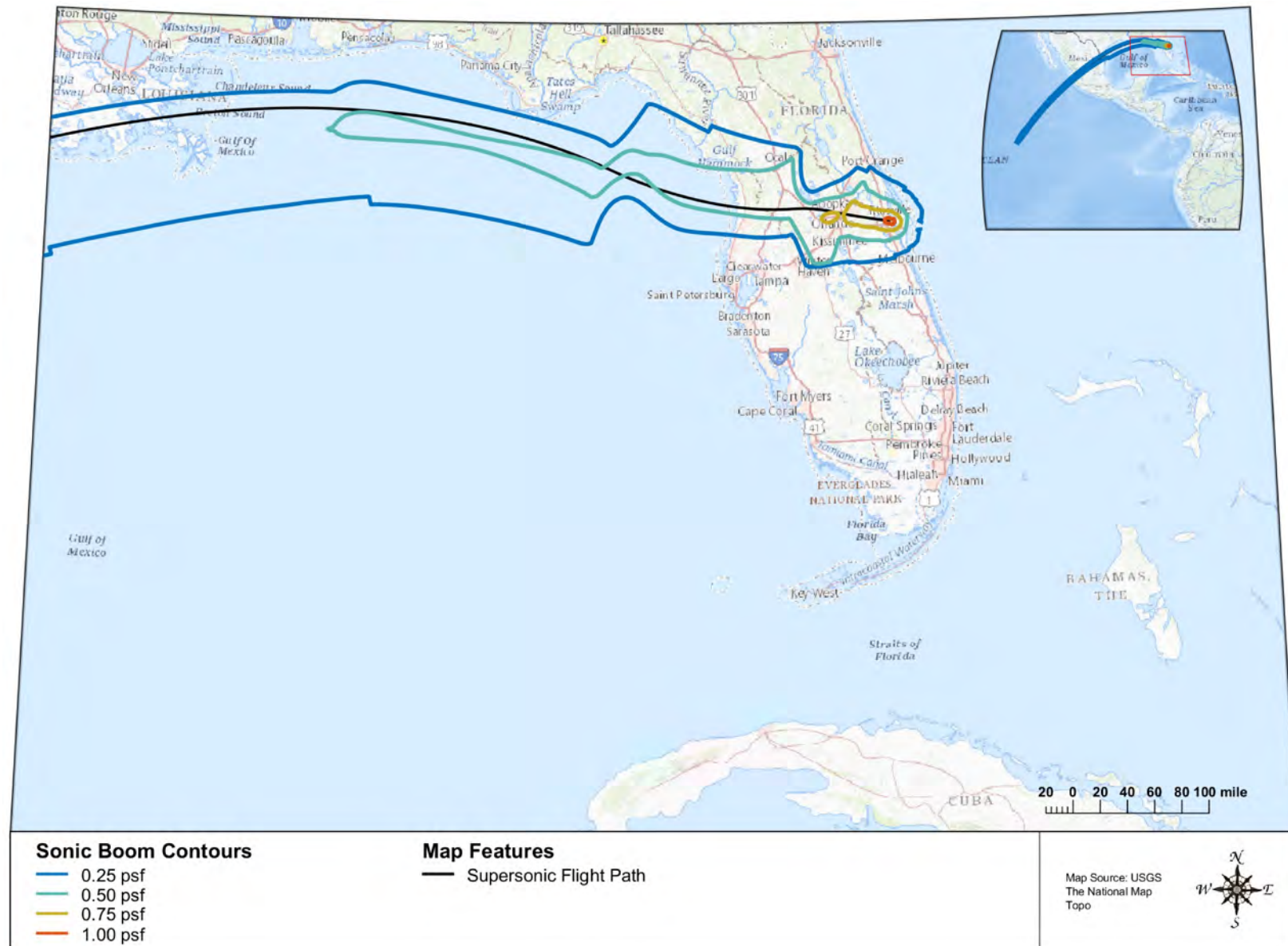


Figure 11. Sonic boom contours for the northern boundary of reentry trajectories to Runway 33



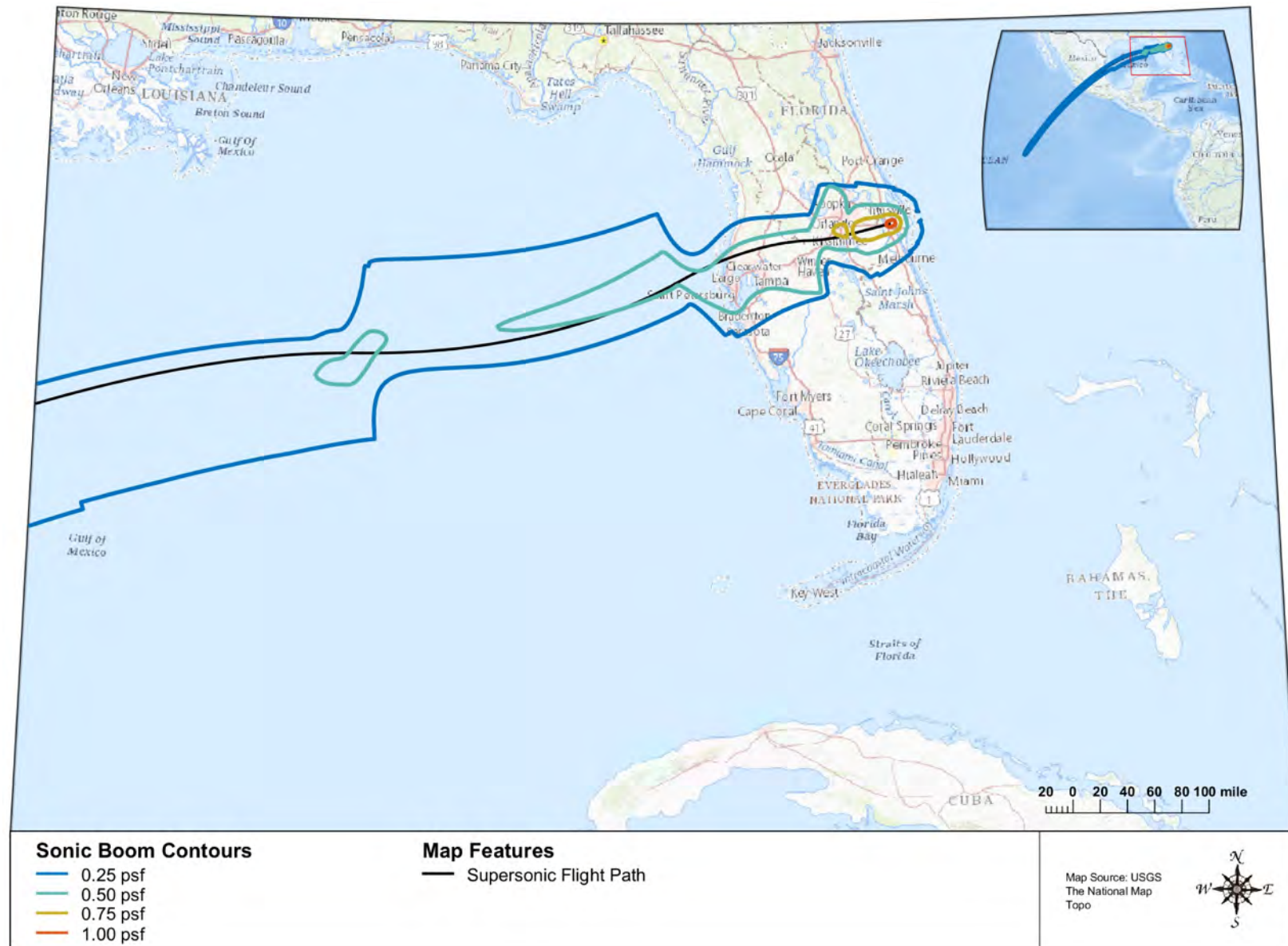


Figure 12. Sonic boom contours for the northern reentry trajectory to Runway 33



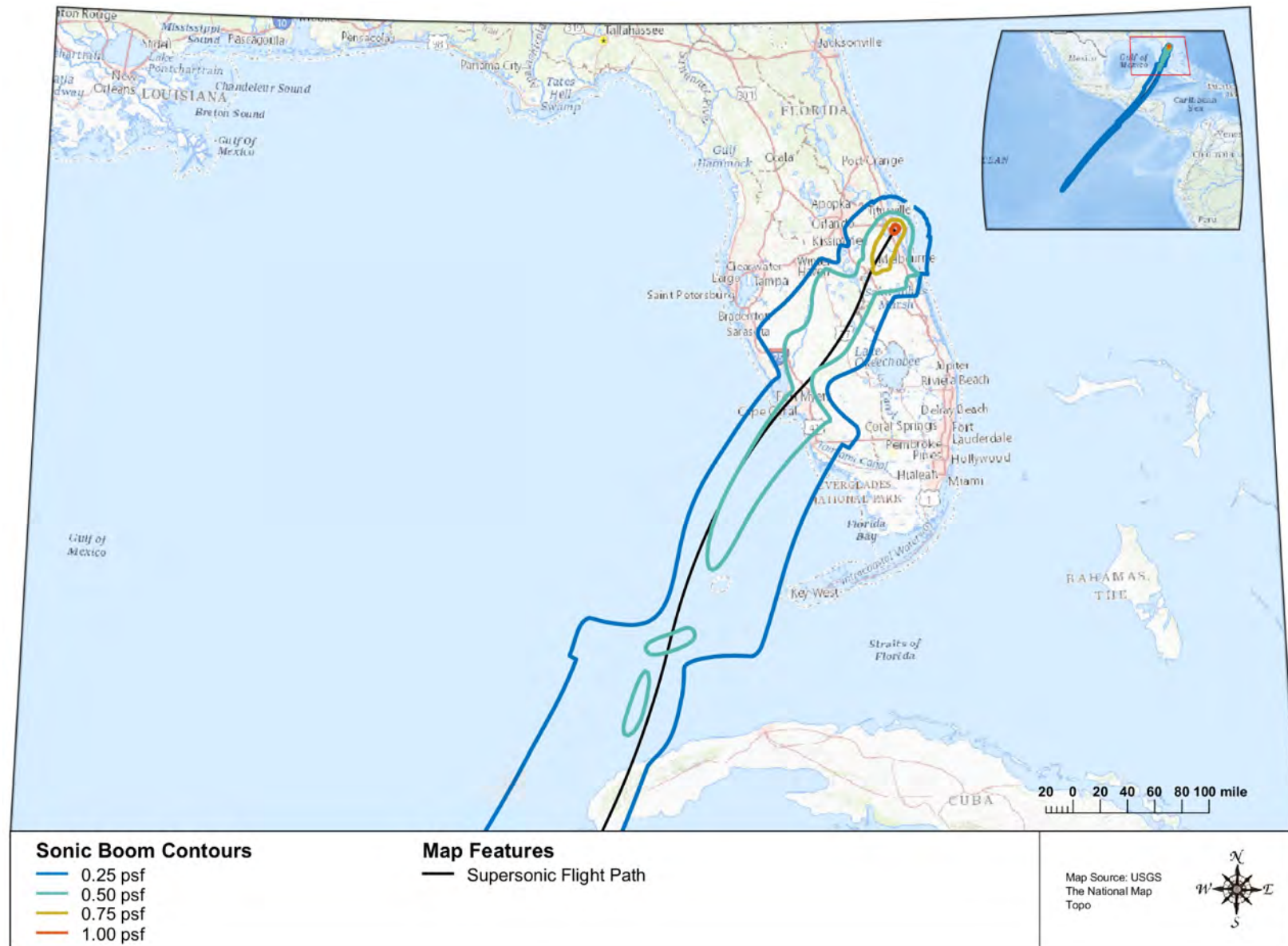


Figure 13. Sonic boom contours for the nominal trajectory to Runway 33

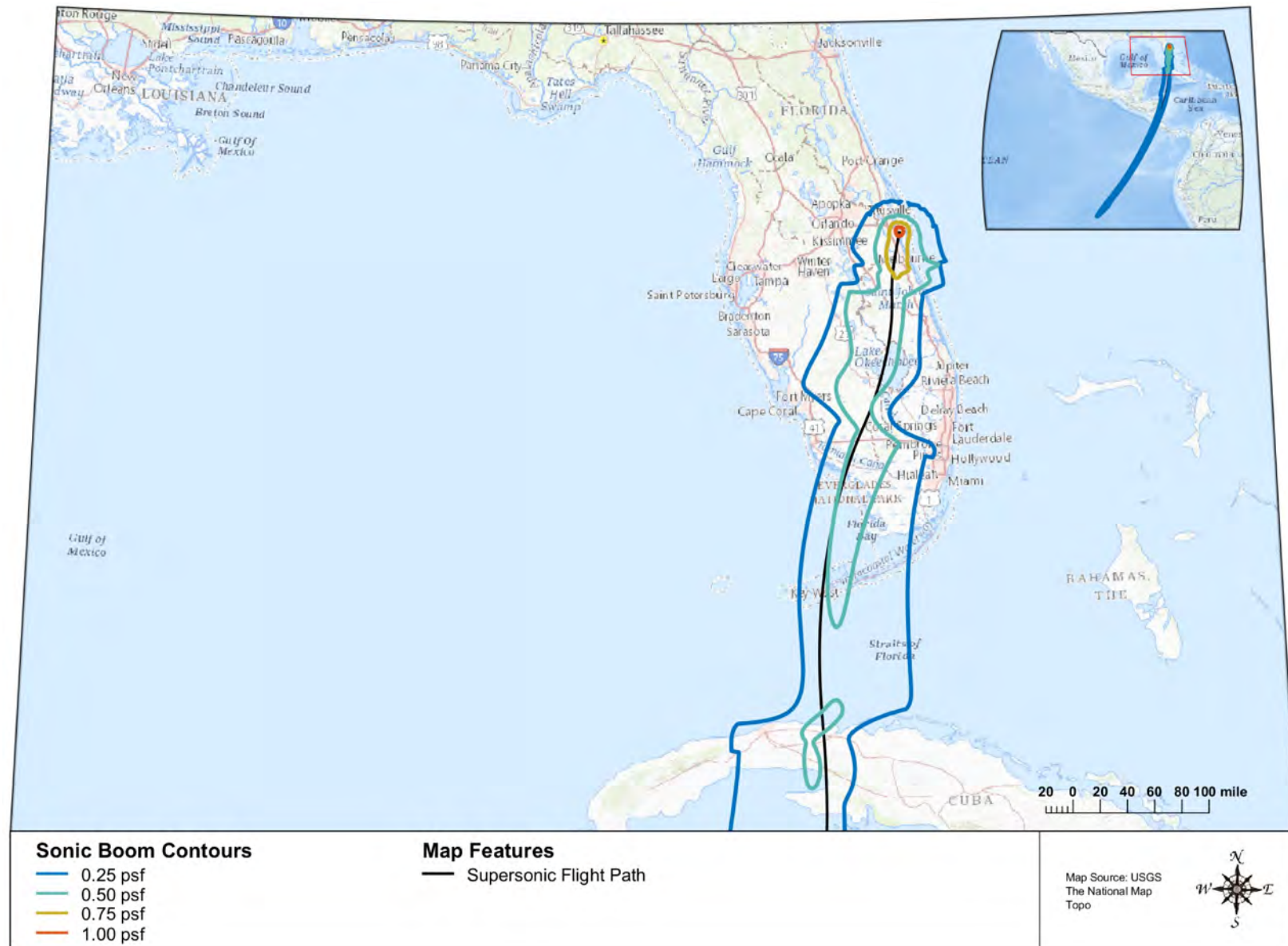


Figure 14. Sonic boom contours for the southern reentry trajectory to Runway 33

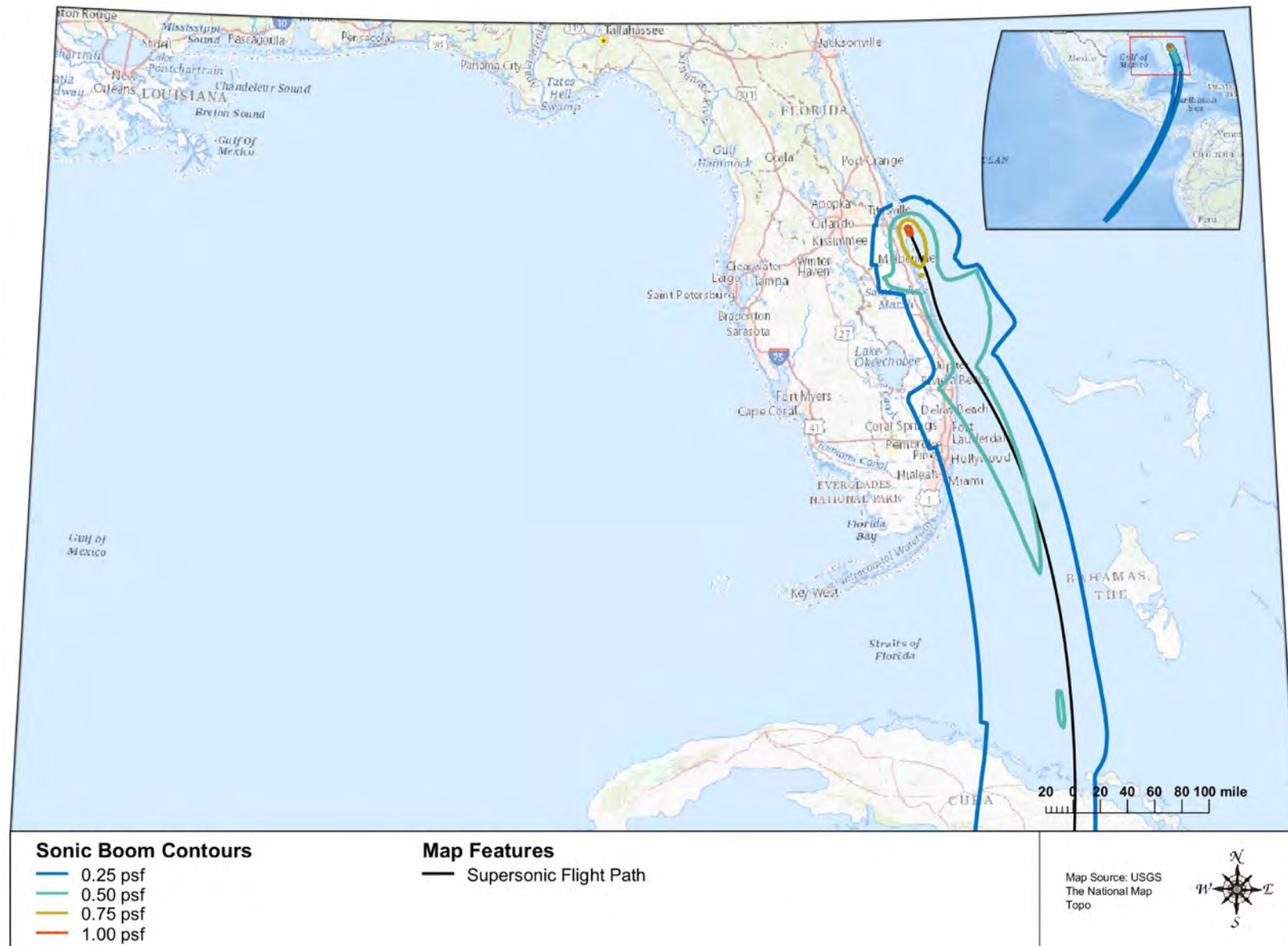


Figure 15. Sonic boom contours for the southern boundary of reentry trajectories to Runway 33



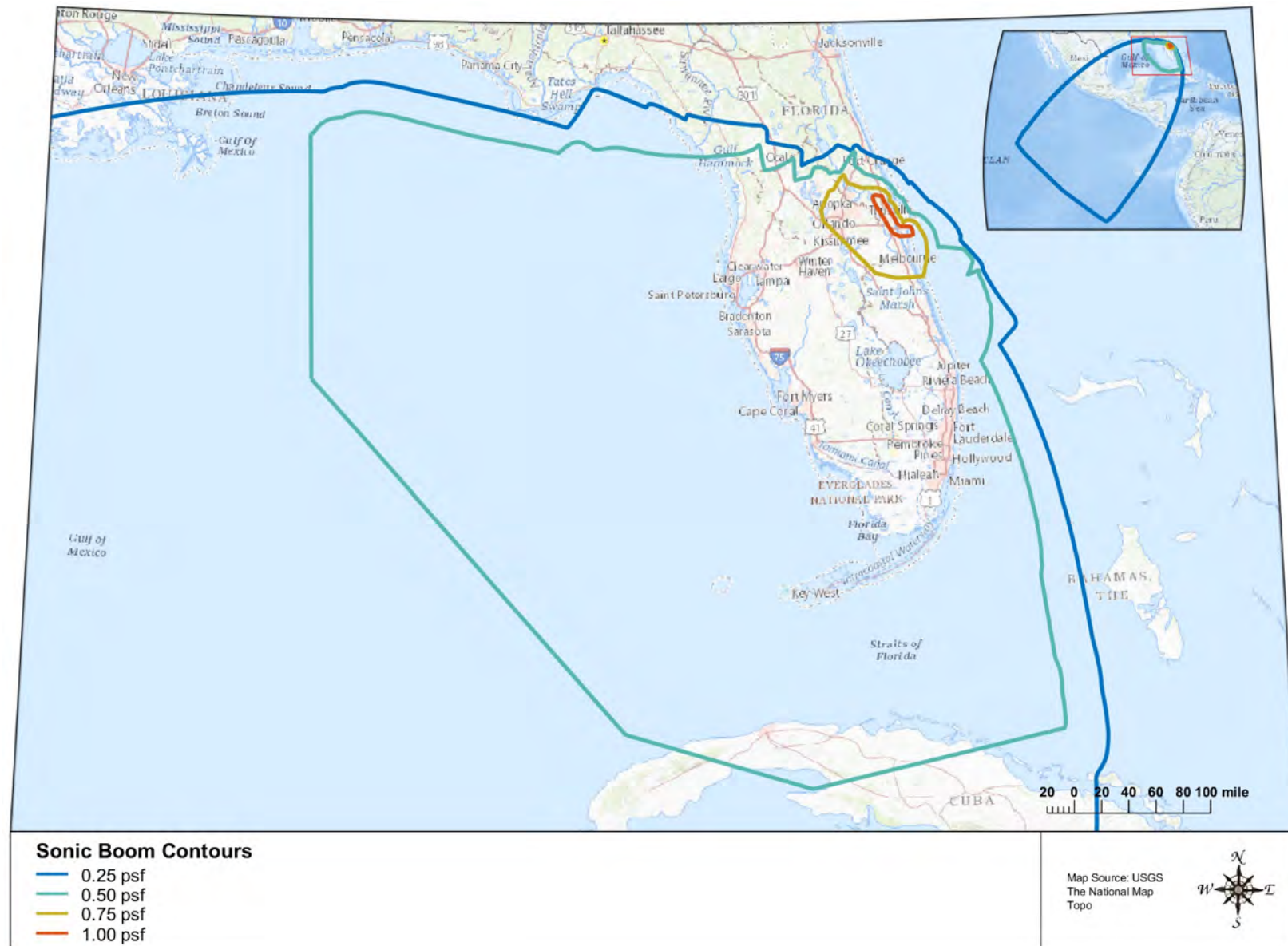


Figure 16. Sonic boom contours for the envelope of reentry trajectories

## 6 Summary

This report documents the sonic boom analysis performed as part of Space Florida's efforts to obtain an RSOL for the SLF. Space Florida is proposing to offer the SLF to potential commercial reentry operators for orbital reentries and landings up to six times annually. Sierra Nevada Corporation's Dream Chaser spacecraft was utilized as the representative reentry vehicle for this analysis. Sonic boom modeling was conducted for ten representative trajectories to evaluate the potential for sonic boom impacts across the range of possible reentry azimuths.

The potential for sonic boom impacts is evaluated on a single-event and cumulative basis in relation to human annoyance, hearing conservation and structural damage criteria. The modeled maximum peak overpressure is approximately 1.1 psf. A modeled maximum of 1.1 psf translates to an equivalent CDNL of 41 dBC for the maximum projected reentry operation tempo. Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure is less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). The potential for hearing damage (with regards to humans) is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criteria. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

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*APPENDIX C: USING THIS PROGRAMMATIC EA  
TO TIER FUTURE NEPA REVIEWS*



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## **C.1 Using this Programmatic EA to Tier Future NEPA Reviews**

### **C.1.1 What Is A Programmatic NEPA Document?**

A programmatic document is a type of NEPA document (either an EA or EIS) from which future EAs and EISs can be tiered. Programmatic EAs and EISs are prepared for broad federal actions. Programmatic documents are useful in providing the basis for subsequent project-level specific environmental reviews. Programmatic NEPA reviews are subject to the same process and procedural requirements as other EAs and EISs.<sup>1</sup>

### **C.1.2 How Are Programmatic NEPA Documents Different from Project-Specific NEPA Documents?**

Programmatic and project-specific NEPA documents differ in the scope of their analyses. Project-specific EAs and EISs tend to focus on specific actions at specific locations. In contrast, programmatic EAs and EISs tend to be broader in scope and tend to be less specific. A programmatic document should consider the potential environmental impacts of the future implementation of policy, projects, or actions, even if they are not fully known. In contrast, a project-specific NEPA document analyzes the impacts of an action within known and clearly defined parameters.

### **C.1.3 What Is Tiering?**

Tiering refers to the coverage of general matters in broad NEPA reviews (such as programmatic EAs or EISs prepared for policies, programs, or broad groups of related actions) with subsequent narrower statements or analyses (such as project-level or site-specific EAs or EISs) that are tiered from the broader programmatic documents (see 40 CFR § 1508.28). Tiering allows for more efficient and focused analyses. Instead of restating material, information from a programmatic NEPA review can be incorporated into subsequent tiered reviews by reference (see 40 CFR § 1502.21). The advantage of tiering is that it reduces and eliminates a redundant or duplicative analysis that has already been considered at the programmatic level, thereby expediting the preparation of future site- or project-specific NEPA reviews. Tiering can also be used to sequence environmental documents from the early stage of a proposed action (e.g., need for the action and site selection) to a subsequent stage (e.g., proposed construction) to help focus on issues that are ripe for decision and exclude from consideration issues not yet ripe or already decided (see Paragraph 3-2 of FAA Order 1050.1F).

### **C.1.4 Why Is This Proposed Action Being Analyzed in a Programmatic NEPA Document?**

Under the FAA licensing process, separate licenses must be obtained for operation of a commercial space launch or reentry site<sup>2</sup> and operation of a commercial space vehicle.<sup>3</sup> Space Florida's proposal is to obtain a Reentry Site Operator License (RSOL) to allow for the operation of commercial space reentry vehicles at

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<sup>1</sup> FAA Order 1050.1F, Paragraph 3-2 outlines the FAA's procedures for programmatic documents and tiering.

<sup>2</sup> 14 CFR § 420.15(b) discusses environmental review requirements for licenses to operate a launch site; 14 CFR §§ 433.7 and 433.9 discuss environmental review requirements for licenses to operate a reentry site.

<sup>3</sup> 14 CFR §§ 415.201 and 415.203 discusses environmental review requirements for launch licenses for expendable launch vehicles; 14 CFR §§ 431.91 and 431.93 discusses environmental review requirements for launch and reentry of reusable launch vehicles.

the Shuttle Landing Facility (SLF). The new capabilities would include establishing reentry corridors and recovery and post-reentry processing of reentry vehicles landing at the site.

The Proposed Action analyzed in this programmatic NEPA document does not include the issuance of reentry licenses to commercial space vehicle operators. When a reentry vehicle operator applies to the FAA for a license to conduct reentry operations at the SLF, a separate environmental document would be required to provide a more detailed analysis based on vehicle-specific parameters and operations.

The FAA has determined that analyzing the issuance of an RSOL to Space Florida in a programmatic document is an effective way to sequence environmental documents between Space Florida's RSOL and subsequent stages when a vehicle operator applied for a reentry license for the site. The FAA will tier subsequent documents from this Programmatic EA (PEA) to focus on environmental impacts specific to a vehicle applicant's proposed operations under a reentry license.

#### **C.1.5 What is Addressed in This PEA and How Will Future Reviews be Tiered?**

At present, the only FAA decision under consideration is FAA issuance of an RSOL to Space Florida. This PEA uses the Sierra Nevada Corporation's Dream Chaser vehicle as the basis of analyses for conceptual reentry operations. This PEA analysis reflects the broad and general environmental impacts that may be expected to result from these type of reentry operations.

For any commercial reentry vehicle operator that approaches the FAA with a proposal to conduct reentry operations at the SLF (including Sierra Nevada Corporation), the FAA will assess the particular aspects of the operator's proposal in a subsequent NEPA review that will tier from this PEA. Table C-1 outlines the analyses that will be deferred until an operator proposes to conduct reentry operations at the SLF and that therefore will be covered in the tiered NEPA document. Table C-1 also describes the aspects of reentry operations which, if aligned exactly with the conceptual operations analyzed in this EA, may be incorporated by reference into the tiered document instead of being analyzed separately. However, all proposed reentry operations will require some level of tiered NEPA documentation, regardless of whether operations are aligned exactly with the conceptual reentry operations in this PEA.

**Table C-1**  
**PEA Components to be Analyzed in Future Environmental Reviews**

<b>FAA ACTION</b>	<b>PROJECT COMPONENTS AND ASSUMPTIONS ANALYZED IN PEA</b>	<b>COMPONENTS TO BE ANALYZED IN FUTURE TIERED REVIEWS</b>	<b>COMPONENTS TO BE INCORPORATED BY REFERENCE IN FUTURE TIERED REVIEWS</b>
Issuance of an RSOL for reentries of a commercial vehicle at the SLF	Operation of a commercial reentry vehicle	Specific details of operator's proposed reentry vehicle, including vehicle type, flight profiles, propellant type and quantity, and reentry trajectory.	Where the operator's proposal aligns with conceptual reentry vehicle operations, the tiered EA will incorporate the PEA analysis by reference. Where the operator's proposal deviates, the tiered EA will present a detailed analysis of the potential for environmental impacts not presented in the PEA.
	Up to six reentry operations annually and up to 17 over five years	Number of annual reentry operations in the operator's proposal.	If annual operations are less than the number analyzed in this PEA, the tiered EA will incorporate the relevant components of this PEA by reference. If the operator proposes a greater reentry frequency (for example, if an operator proposes one reentry operation a month for a total of twelve reentry operations annually), the tiered document will present a detailed analysis of the potential for environmental impacts likely to result from this reentry frequency.
	Up to four daytime reentries and up to two nighttime reentries	Timeframe for reentry operations in the operator's proposal.	If all reentries are proposed to be conducted during the hours analyzed in this PEA, the tiered EA will incorporate the relevant components of this PEA by reference. If the operator proposes a different timeframe for reentry operations (for example, four nighttime reentries and two daytime reentries), the tiered document will present a detailed analysis of the potential for environmental impacts likely to result from the new proposed timing.

FAA ACTION	PROJECT COMPONENTS AND ASSUMPTIONS ANALYZED IN PEA	COMPONENTS TO BE ANALYZED IN FUTURE TIERED REVIEWS	COMPONENTS TO BE INCORPORATED BY REFERENCE IN FUTURE TIERED REVIEWS
	40 new permanent full-time employees to support proposed operations at the SLF	Number of new employees needed based on the operator's proposal.	If the number of new employees needed is less than the 40 analyzed in this PEA, the tiered EA will incorporate the relevant components of this PEA by reference. If the operator proposes reentry operations requiring greater staff levels, the tiered document will present a detailed analysis of the potential for environmental impacts likely to result from a significant influx of new personnel at the SLF.
Airspace modifications to accommodate operation of the reentry vehicle	Airspace procedural changes, coordination, and notifications based on proposed operations of the described reentry vehicle	Designation of reentry vehicle operating areas. The tiered EA will include an evaluation and designation of a new reentry vehicle operating area. While the vehicle will be required to operate within the parameters established in this PEA, a new reentry vehicle operating area may be designated based on the needs of the vehicle proposed for operation.	To the extent that the proposed reentry vehicle operating area aligns with that analyzed in this PEA, the tiered EA will incorporate the PEA analysis by reference. Where the proposed reentry vehicle operating area deviates from that analyzed in this PEA, the tiered EA will present a detailed analysis of the potential for environmental impacts.

## *APPENDIX D: AIRFIELDS AND AIRSPACE*

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## **D.1 Airfield and Airspace Impacts**

### **D.1.1 No Action Alternative**

Under the No Action Alternative, the FAA would not issue a reentry site operator license to Space Florida and the commercial reentry operations associated with the Proposed Action would not occur. There would be no impacts on airfields or airspace associated with the No Action Alternative and current airspace designations in the vicinity of KTTS would remain in place. National airspace initiatives including the Next Generation Air Transportation System and Space and Air Traffic Management System would continue to be implemented under the No Action Alternative.

### **D.1.2 Proposed Action**

#### **Reentry Site Operator License and Future Reentry Operator Licensing Process**

This PEA evaluates the potential impacts of the FAA issuing a reentry site operator license to Space Florida to offer the National Aeronautics and Space Administration's (NASA's) Shuttle Landing Facility (SLF) as a location to conduct commercial reentry operations based on the conceptual reentry operations analyzed for the Sierra Nevada Corporation (SNC) Dream Chaser reentry vehicle. However, prior to any reentry operations, each separate reentry vehicle operator would need to obtain a specific reentry license from the FAA for their vehicle type and trajectory. The licensing of specific reentry operators is a detailed and specific process that would occur beyond the publication date of this PEA. An environmental analysis that tiers from this PEA would be prepared to analyze the impacts of a vehicle operator proposing to conduct reentries at the SLF (see Appendix C for more information).

In 2018 an airspace letter of agreement, for both launch and reentry operations, was signed and included in the approved Part 420 Launch Site Operator License for the SLF. This agreement established the framework for developing "procedures for the issuance of Notices to Airmen, Altitude Reservation Special Activity Airspace access." Given Space Florida's use of hypothetical launch and reentry vehicle operations, it was not possible for ATC and Space Florida to include specific measures in the agreement at the time it was developed. Rather, the parties worked to establish a commitment to collaboratively develop an outline for the necessary plans and procedures to be developed at a later time.

Prior to reentry operations, designated Space Florida personnel would notify the reentry operator of other activities at the SLF and resolve potential conflicts for use. Space Florida would also work with the Kennedy Space Center Spaceport Integration Office to ensure that planned reentries would not interfere with NASA, U.S. Fish and Wildlife Service, U.S. Space Force, National Park Service, National Security Agency, National Geospatial-Intelligence Agency, National Oceanic and Atmospheric Administration, or other commercial operations.

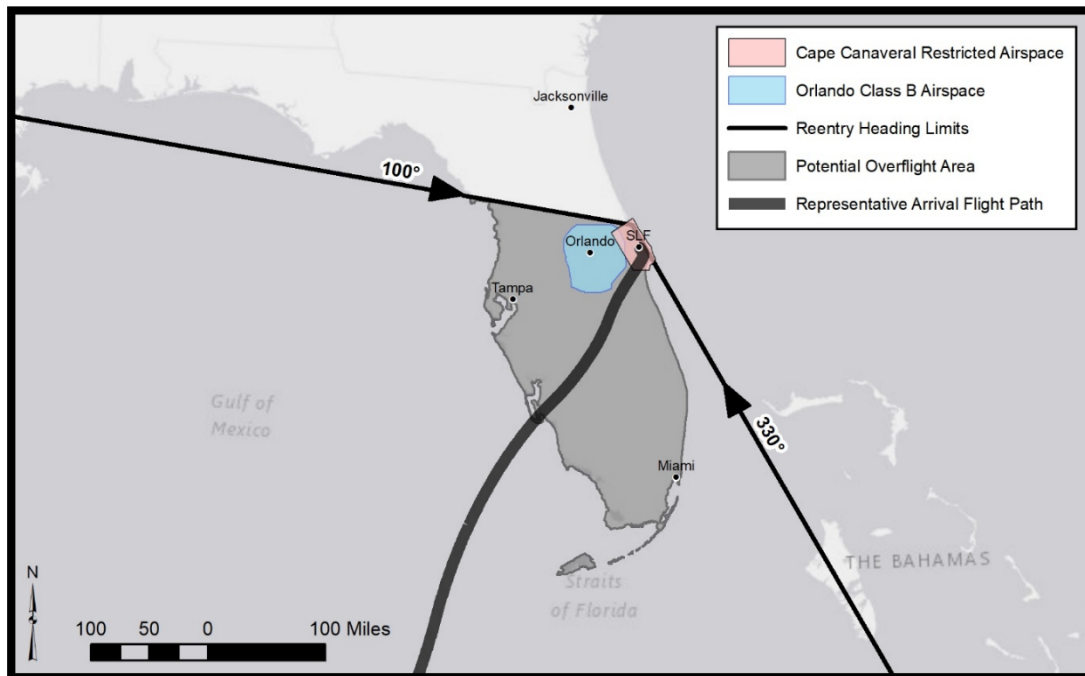
Future reentry operators would be required to apply for a Part 435 reentry vehicle license and to obtain their own letter of agreement with ATC. At that time, the operator would be able to provide specific data describing its vehicle and missions that the FAA could use to identify specific safety measures and the effect of implementing those measures on the airspace. The reentry vehicle license process would work with ATC to schedule its missions according to the process outlined in the agreement. Mission planning would include collaboration between the reentry vehicle operator and ATC to identify the reentry flight path to

the SLF, as well as the location and timing of the airspace closure associated with the reentry flight path that considers its effect on other users of the National Airspace System. FAA ATC would ensure reentry operations are safely and efficiently integrated into the NAS by approving, modifying, or denying all airspace decisions associated with reentry operations.

### **Reentry Operations**

Operations of the commercial reentry vehicles at SLF include an un-powered, gliding horizontal landing. The reentry vehicle would reenter from west/southwest on an ascending reentry trajectory before landing at the SLF (see Figure D-1). Ascending reentry trajectories include high atmospheric overflight of Central American countries as well as overflight of the southern half of Florida, south of 29° North latitude. The reentry vehicle would descend below 60,000 feet altitude above mean sea level (MSL) approximately 30-40 miles from the SLF prior to landing and would be operating below 60,000 MSL for less than 30 seconds before entering Cape Canaveral Restricted Airspace. The reentry vehicle would remain in the Cape Canaveral Restricted Airspace for the remainder of its reentry and landing at the SLF (for approximately 2.5 – 3 minutes).

**FIGURE D-1: PROPOSED REENTRY VEHICLE FLIGHT PATH APPROACHES**



Source: (Sierra Nevada Corporation, 2019)

### **Summary of Potential Impacts of the Proposed Action**

Prior to the issuance of any reentry vehicle operator licenses, the FAA, the reentry vehicle operator, and Space Florida would apply specific vehicle and operational parameters to the development of the letter of agreement required in part 435. During the licensing process, the FAA would identify potential effects on the airspace associated with the operations and address those effects in greater detail in the environmental review, where more detailed information is available.

The Proposed Action would result in no physical changes to the airfield as there are no construction activities associated with the proposed action. Immediately prior to a reentry and landing of a reentry vehicle, air traffic control would ensure that the runway at KTTS is clear of other aircraft.

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